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Surgeries and Cardiovascular System

Highlights

- Randomized Control Trial
- Snodgrass Hypospadius Repair
- Genuine Medical Discontent
- Hypospadias Clinical Experience

Discovering Thoughts, Inventing Future

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Contents of the Issue

i. Copyright Notice
ii. Editorial Board Members
iii. Chief Author and Dean
iv. Contents of the Issue

1. A Genuine Medical Discontent: A Case Report of Methicillin-Sensitive Staphylococcus Aureus in A Previously Healthy Man Who Sustained 35% Total Body Surface Area Burns with Non-Inhalation Injury, and Died Due to the Complications of the Disease Process. *1-3*
2. A Prospective Single-Centre Randomised Controlled Study to Compare the Time to Healing of Partial Thickness Burn Wounds Treated with Versajet, Biobrane and Acticoat to Conventional Therapy. *5-12*
3. Prediction of Difficulty of Laparoscopic Cholecystectomy by Preoperative Ultrasonography: A Randomized Control Trial. *13-18*
4. Snodgrass Hypospadius Repair, One Stage Urethroplasty for Mid-Shaft and Distal Hypospadias. Clinical Experience and outcome of 44 Patients. *19-26*

v. Fellows and Auxiliary Memberships
vi. Process of Submission of Research Paper
vii. Preferred Author Guidelines
viii. Index

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A Genuine Medical Discontent: A Case Report of Methicillin-Sensitive Staphylococcus aureus in a Previously Healthy Man who Sustained 35% Total Body Surface Area Burns with Non-Inhalation Injury, and Died Due to the Complications of the Disease Process

By Ismail Al-Malki
University of Cape Town, South Africa

Abstract: Introduction: Shack fires are very common at the informal settlements around South Africa - leading to an increase in number of victims of burn injuries.

Case History: A 32 year old with no known past medical history sustained 35% Total Body Surface Area (TBSA) partial thickness and full thickness burns to the chest, back, head and both arms due to a shack fire. Seven days after admission, the patient's developed infective endocarditis and acute aortic regurgitation. Despite the appropriate antibiotic treatment of Piptaz and cloxacillin administered for five days after the infection was detected, the patient died due to complications of the disease process.

Discussion: Infections in burn patients are often acquired after admission to the hospital.Delayed diagnosis results are noted to cause higher rates of mortality.This can be accelerated by bacterial infections in patients sustaining burn injuries.

Keywords: aortic regurgitation, burn injuries, cloxacillin, endocarditis, MSSA, MRSA, sepsis.

GJMR-I Classification: NLMC Code: QW 161.5.S8, WC 250

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A Genuine Medical Discontent: A Case Report of Methicillin-Sensitive Staphylococcus aureus in a Previously Healthy Man who Sustained 35% Total Body Surface Area Burns with Non-Inhalation Injury, and Died Due to the Complications of the Disease Process

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Keywords: aortic regurgitation, burn injuries, cloxacillin, endocarditis, MSSA, MRSA, sepsis.

I. Introduction

Shack fires are very common in informal settlements in South Africa. Burn patients are at high risk of infection on the damaged skin impairing humoral and cellular immunological response. Notwithstanding medical advances made in the treatment, control and management of infection over the years, there still remain challenges and complications in burn wound infections causing morbidity or mortality[1, 2]. In South Africa, a gap in reporting burn-related injuries or complications in adults is identified in literature. The paper presents a rare reported case of a burn patient with infective endocarditis and aortic regurgitation due to MSSA bacteremia in South Africa.

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II. Case Report

A 32 year old male, with no known past medical history was referred to the burn unit (the ward) with a history of 35% total body surface area (TBSA) partial thickness/full thickness burns to the chest, back, head and both arms due to a shack fire. Upon admission the patient had a flamazine dressing applied at the prior public hospital to all of the burned area and he was continued on daily flamazine dressing at the ward with no skin scrubbing done. The patient was in a stable condition with no complaints and ambulatory. On the second day of admission the patient was noticed to develop have an isolated temeperature spike to 38.6C and was initiated on Piperacillin-Tazobactam (Piptaz) empirically based on the assumption of hospital acquired infection and a blood culture was sent.The Patient was scheduled for debridement one week later due to the long waiting list for theatre.On day seven of admission the patient was taken to the operating theatre for debridement and skin grafting. He was intubated in the operation room without difficulty, a central line was placed. The patient received fentanyl, propafol, cisatracurium, valium prior to his operation in the morning. His vital sign was heart rate 100, blood pressure 110/80 mmHg, respiratory rate 14, temperature 37.8°C and SAT 99%. After 15 minutes of intubation, his blood pressure dropped, the electrocardiographic (EGC) monitor showed a ventricualar fibrillation rhythm, and the patient was noted to be pulseless on palpation. He was defibrillated with 150 joules of electricity. Chest compressions commenced immediately and the patient had 2 cycles of chest compressions with 1mg of adrenaline given. There was a return of spontaneous circulation at a rate of about 80 beats/minute with sinus rhythm. He received neostigimine, glycopyrrolate as a reversal. The operation was aborted. In the afternoon, he was extubated and was assessed to be in a stable

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condition and fully conscious then transported to burn intensive care unit (ICU).

Cardiac enzymes were performed and the results showed a high level of troponin I. The patient was seen by the cardiologist on call in same day, who felt that the patient clinically had pericarditis and VF. His recommendation was to treat the patient for sepsis and the patient was booked for transesophageal echo. The following day the blood culture results identified methicillin-sensitive

staphylococcus aureus, and cloxacillinwa treatment. Other investigations,
such as full blood count and electrolytes werenormal.

A chest Xray was normal. Five days post operation (day 12 in the hospital), while in the burn ICU, the patient developed respiratory distress with tachypnea and shortness of breath requiring intubation and ventilation. The patient was placed on a pressure controlled ventilator and given sedatives. A new soft diastolic murmer was noted. Chest Xray at this time showed multi-lobar pneumonia. The same day a transesophageal echo performed by Cardiology revealed acute severe aortic regurgitation and Infective endocarditis on the aortic valve as well as cords of the mitral valve. Treatment for infective endocarditis was intiated with cloxacillin, gentamycin and Piptaz with a plan for aortic valve repair at 6 weeks. The following day he developed cardiac arrest and died after 13 days of admission.

III. Discussion

Staphylococcus aureus (S. aureus) is a pathogen that causes a multitude of diseases that include skin and soft tissue infections, endocarditis and pneumonia. S. aureus is highly prevalent in South Africa as elsewhere worldwide [3, 4] and is often seen in patients with significant burns [1, 5, 6]. Both methicillin-resistant (MRSA) and methicillin-susceptible (MSSA) bacteremia can cause infections and sepsis that can lead to death in burn patients [7]. The rate of infections that cause morbidity and/or mortality is positively correlated with TBSA in two studies[5, 7,] however a study by Fadeyibi et al found no relationship[2]. In South Africa high rates of MRSA above 25% isolates from clinical samples are reported for MRSA[3, 8,] but not in the case of MSSA. However, one study from Western Cape revealed that the majority of S. aureus isolates were MSSA at one hospital[9]. S. aureus bacteremia in burn patients has been shown to cause infective endocarditis and aortic regurgitation[1, 6, 10.] In this case study S. aureus was susceptible to all lactam antibiotics (cloxacillin, erythromycin, clindamycin and cotrimoxazole) except penicillin/ampicillin, parallel to other South African studies [3, 4.] Cloxacillin is highly effective for treatment of endocarditis due to MSSA [10,] as well as continued [6] weeks treatment with appropriate antibiotics[1.] Despite this appropriate antibiotic treatment of Piptaz and cloxacillin administered for five days after admission, the patient died. Delayed diagnosis results are noted to cause higher rates of mortality[6].

The patient had a central line which was removed 7 days after insertion then the tip of central line sent for culture and it was negative. Positive blood culture (MSSA) results identified on day 7 suggest that the patient acquired the infection in the ward after admission but prior to central line placement. In addition to positive blood culture, a fever with a new diastolic murmer is indicative of endocarditis seen on mitral and aortic valves. Possible source of the bacteremia could be attributed to the loss of the skin barrier following burn injury (natural defence barrier to infections) and making the patient prone to hospital acquired infection. Manipulation of wounds can be also a source of bacteremia that caused endocarditis[1, 6]. Presumably, the patient acquired MSSA infection prior to going to the operating theatre (based on the timing of the positive blood cultures) and developed infective endocarditis resulting in severe aortic regurgitation. It was postulated that the severe aortic regurgitation led to the cardiovascular collapse that ended in the death of the patient.

This study demonstrates that there is need to increase prevention measures to reduce external sources of infection on patients in hospital environment. Strict adherence to high hygienic standards by staff in patient handling in dressing wounds could minimise infection transmission and thereby decrease mortality.

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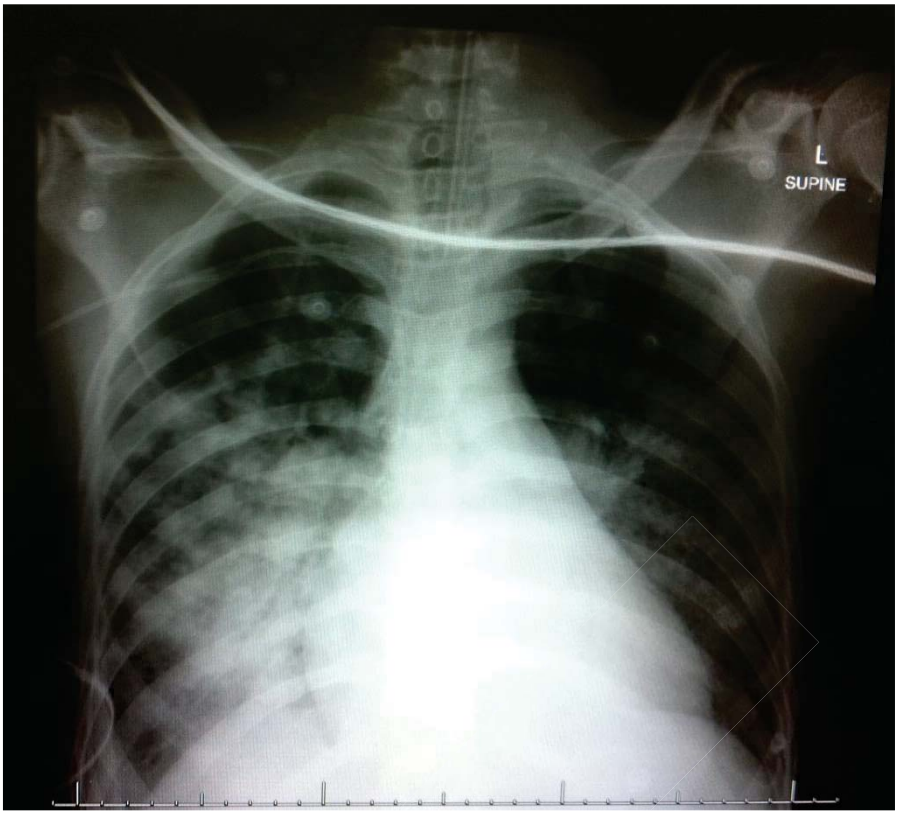

Figure 1: Chest Xray showing multi lobar pneumonia

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A Prospective Single-Centre Randomised Controlled Study to Compare the Time to Healing of Partial Thickness Burn Wounds Treated with Versajet, Biobrane and Acticoat to Conventional Therapy

By A Muganza & L Cullingworth
University Of Witwatersrand, South Africa

Abstract- *Background:* Burns in South Africa account for significant morbidity, mortality cost. Treatment options that could ease this burden require exploration.
Objectives: The primary objective was to compare the time to healing of partial thickness burn wounds treated with Versajet, Biobrane and Acticoat to conventional therapy.
Methods: A randomised, controlled, prospective study was undertaken.
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A Prospective Single-Centre Randomised Controlled Study to Compare the Time to Healing of Partial Thickness Burn Wounds Treated with Versajet, Biobrane and Acticoat to Conventional Therapy

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Abstract- Background: Burns in South Africa account for significant morbidity, mortality cost. Treatment options that could ease this burden require exploration.

Objectives: The primary objective was to compare the time to healing of partial thickness burn wounds treated with Versajet, Biobrane and Acticoat to conventional therapy.

Methods: A randomised, controlled, prospective study was undertaken.

Results: One hundred and twenty one patients were randomised, and 96 were analysed. Median time to healing was slightly shorter for Biobrane-treated patients in the pediatric sub-group (21.7 [±9.0] versus 23.7 [±9.4], p=0.5361), and slightly longer in the adult sub-group (19 [12-25] versus 18.5 [12-27], p=09695). Healing rates were higher for Biobrane-treated patients in the paediatric sub-group (84.6% versus 68.4%, p=0.197), and lower in the adult subgroup (78.3% versus 85.7%, p=0.487). . The absolute risk reduction (ARR) for Biobrane-treated patients in the paediatric sub-group was 0.16 (16%), yielding a number-needed-to-treat (NNT) of 6. The median number of dressing changes was significantly lower for Biobrane group in the adult and paediatric population (6.2 [±3.6], p=0.0003; and 7.6 [±4.8] versus 10.7 [=4.8], p=0.039). The mean cost per healed burn for Biobrane group was lower in the paediatric population (R111, 385 versus R143,917), and higher in the adult population (R54, 290 versus R90.175).

Conclusion: Biobrane and Acticoat did not lead to a significant decrease in the time to healing, we believe the associated reduction in dressing changes to be important. Together with the obsereved cost reduction to heal partial thickness burns in children, we recommend this regime therapy in a paediatric setting, and have adapted our Standard of Care accordingly. We have identified a subgroup of adult patients who will benefit of the application of skin substitutes.

I. Introduction

In 2008 burns accounted for the majority (19%) of all non-transport injury deaths in South Africa [1], and are a significant cause of paediatric morbidity [2] and mortality [3]. The costs associated with the treatment of burns are considered to be large [4]. Due to resource constraints in South Africa, treatment options that can ease this burden without compromising clinical outcomes are starting to be explored [5]. The need for daily dressing changes has not only been shown to increase the cost of burn wound care in some instances, but is also associated with pain and trauma, which is of particular importance in the paediatric patient [6].

A standard of care (SOC) depends on the number of factors, including experience, expertise and resource availability [7]. Our existing SOC for partial thickness scald or fire burn consists of initial cleaning and/or debridement in the ward or theatre, followed by the daily application of silver sulphadiazine dressing. The adoption of this particular SOC may not represent the most clinically appropriate or efficient form of resource allocation.

Biobrane is a biosynthetic wound dressing, and is becoming more widely used in the management of burns, particularly partial thickness burns in paediatric patients [8]. When used appropriately, it has been shown to offer significant advantages over more conventional therapy , including decreased time to heal [9], decreased length of stay [9-11], fewer dressing changes [10] and decreased costs [10, 11]. The removal of necrotic skin, tissue and/or infectious materials is the primary goal in the initial treatment of burn wounds [12]. While surgical debridement is considered the goal standard, it has been suggested that a hydrosurgery system such as Versajet may have advantages over traditional escharectomy in burn patients [12]. Versajet utilises a fluid jet under high pressure, and has been shown to be effective at cleaning and debriding superficial and intermediate depth burn wound prior to the application dressings like Biobrane [13]. A number of institutions have adopted nanocrystalline silver (NC) dressing as the SOC for first-line topical prophylactic treatment of burn-wound infectious [7, 14]. Acticoat is a NC dressing that can stay in place for up to 72 hours.

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We hypothesized that the advantages described for Biobrane in the treatment for partial thickness burns combined with the prophylactic anti-infective properties of a NC dressing might represent an effective utilization of resources, and set out to investigate this in a randomised controlled study. The primary objective of our study was to compare the time to healing of partial thickness burn wounds treated with Versajet, Biobrane and Acticoat to standard therapy over a period of up to 6 weeks. Secondary objectives were to compare costs, length of inpatient stay, and number of surgical procedures and dressing changes performed in the above groups.

II. Methods

This study was carried out as per the principles laid out in the Declaration of Helsinki and subsequent amendments thereto. It was approved by the Human Research Ethics Committee: (Medical) of the University of the Witswaterstrand (090203). Informed consent was obtained for patients.

All eligible patients between 1 and 60 years of age requiring admission to hospital for partial thickness scald or five burns covering greater than 10% and less than or equal to 40% of total body surface (TBSA), with an estimated healing time of between and 21 days, were invited to participate in the trail.

Following stabilization, patients were randomized Standard therapy or Biobrane using the sealed envelope technique. To ensure broadly comparable patient groups with regard to the % TBSA of the burn, the randomization was stratified according to the estimate initial % TBSA of the burn. In those patients with more than 1 discrete burn, the largest burn was considered the reference wound.

An assumption was made regarding mean time to healing in the 2 groups, and the associate standard deviations, as information was lacking regarding time to healing and the size of the difference Standard therapy and Biobrane. The sample size calculation (conducted using STATA software) resulted in a required sample size of 80 patients.

Patients randomised to Standard therapy had their wounds cleaned and dressed in theatre or in the ward/dressing station, at the discretion of the investigator. A silver sulfadiazene dressing was applied, covered secondarily with abdominal swabs or plastic gauze, and kept in position with a crepe bandage. Daily dressing took place until such time that the reference wound had healed or 6 weeks had passed, in hospital or as an out—patient following discharge. Wound healing was defined as complete epithelialisation in the absence of drainage.

Patients randomised to Biobrane were taken to theatre, where their wounds were cleaned and debrided with Versajet. Biobrane was applied and help in place using staples, tape, sutures or skin closure strips. Acticoat was applied damped over the Biobrane, covered secondarily with Melolin and kept in position with crepe bandage. The Acticoat was removed on Day 3, and re-applied at the discretion of the investigator if secure Biobrane adhesion had not been obtained. If further Acticoat was not required, the wounds were covered with a crepe dressing. On Day 6, staples or sutures are removed at the discretion of the investigator. If there was no adherence, all Biobrane was removed and the burn wounds were treated according to protocol. If the Biobrane was fully adherent or showed signs of purulent pockets, the areas of non-adherence were trimmed out and covered with Acticoat, Melolin and a crepe bandage. Wounds were assessed every 3 days after and Acticoat dressing were changed if in situ, until such time that the wound bed appeared healthy and granulating, at which point the wounds and the remaining adhered Biobrane were covered with a crepe dressing. When the Biobrane stared to lift, loose edges were trimmed. This process was repeated every 3 days until such time as the reference wound had healed or 6 weeks had passed.

All patients were evaluated at each dressing change while in hospital, and at out-patients visits hereafter. For each dressing change and theatre visit related to the reference wound, burn-specific and resource-specific information was recorded.

The primary endpoint was the average time to heal the reference burn per group divided by the number of healed reference burns per group. Secondary endpoints for comparison between the 2 study groups included the average cost per healed burn per group, defined as the total cost of treatment for all patients per group at 6 weeks divided by the total number of healed burns per group at 6 weeks, the average length of who in-patient stay per group, with wound healing used as a proxy for discharge date in those patients who couldn't not be discharged due to poor socio-economic circumstances, and the number of surgical procedures and dressing changes performed per group. For numeric variables, medians and inter-quartile ranges were cited for data that was not normally distributed. Cost data was always represented by the average cost per patient.

The cost analysis was performed from a public health sector perspective. The study aimed to quantify direct costs associated with using an ingredients approach. Cost categories included: dressing and other materials, nursing time, surgeon and anesthetist time, theatre levels of care, out-patient treatments, blood products, investigation and medications. Indirect costs, including those pertaining to the patients, and their families and caregivers were not included. South African public sector costs excluding value-added tax (VAT) for the financial year ending February 2011 were used, and

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were expressed in South Africa Rands (R). Costs were allocated on the basis of inputs required to treat the reference wound.

III. Results

Recruitment commenced in April 2009. Following a scheduled interim analysis, the sample size was increased to 100 patients. Due to loss to follow-up for a variety of reasons, a subsequent request to increase sample size from 100 to 120 to allow for analysis on sample close to 100 patients was made and granted. Patient enrolment was compelled in January 2012. Study subjects were analysed on a per protocol basis and only patients that completed the study as per protocol were included. In total 121 patients were randomized, of which 96 were analysed. Participant flow, including the protocol violations and reasons for exclusion from analysis, are summarised in Figure 1.

The median age of all the subjects was lower in Biobrane group (6.6[3.4-34.2] versus 23.2[2.3-25.4] years); however this difference was not found to be statistically significant (p=0.0984), and was not apparent in the paediatric (defined in our institution as less than 10 years) and adult sub-groups. Additional baseline characteristics are summarized in Table 1, and are comparable between the 2 groups.

Table 2 illustrates results for primary and secondary outcome measures, and includes a subgroup analysis of both children and adults. The median time to healing was slightly longer in the Biobrane therapy group overall (20.5[13-25] versus 19[14-27], p=0.9919) and in the adult sub-group (19[12-25] versus 18.5[12-27], p=0.9695), and slightly shorter in the paediatric sub-group (21.7[±9.0] versus 23.7[±9.4], p=0.5361). Healing rates were higher in Biobrane-treated patients overall (81.6% versus 78.7%, p=0.877) and in the paediatric sub-group (84.6%versus 68.4%, p=0.197). Healing rates were lower for Biobrane-treated patients in the adult sub-group (78.3% versus 85.7%, p=0.487). The absolute risk reduction (ARR) in the paediatric sub-group for Biobrane-treated patients was 0.16 (16%), yielding a number-needed—to-treat (NNT) of 6.

The median LOS was slightly longer for Biobrane group overall, (18[10-26] versus 17 [12-25], p=0.8978), but the median was shorter in both the adult and paediatric sub-groups (16[9-22] versus 17 [10-20], p=0.6700; and 19 [13-35] versus 20 [14-34], p=0.7685). The median LOS prior to the reference wound being deemed suitable for management on an outpatient basis was shorter for the Biobrane group overall, (10 [5-23] versus 16[12-23], p=0.0417), and also in the adult and paediatric sub-groups (9[5-21] versus 15.5[9.5-20], p=0.0000); and 12.5 [7.24] versus 20 [14-34], p=0.08). As shown in Table 2, the median number of surgical procedures was higher for the Biobrane group than the Standard group (1[1-1] versus 0 [0-1], p=0.0002). Conversely, the number of dressing changes was lower for the Biobrane group overall (5[4-9] versus 10 [8-12], p=0.0001), and also in the adult population (6.2 [±3.6] versus 10.3 [±3.8], p=0.0003) and the paediatric population (7.6 [±4.8] versus 10.7 [±4.8], p=0.039)

The mean cost per healed burn was higher for the Biobrane group overall (R85,780 versus R101,826) and in the adult subgroup (R54,290 versus R90,175). In children the average cost to heal the burn was lower in the Biobrane group (R111,358 versus R143,917). Length of stay was the most significant cost driver across all groups, accounting for between 70 and 80 percent of all costs associated with burn wound management. (Table 3). The mean analgesic costs in the Biobrane-treated subjects were at least half those for the Standard therapy-treated subjects for all patients, including children and adults. The mean anti-infective costs were lower in the Biobrane-treated subjects overall (R241 versus R468, in children (R351 versus R450), in adults (R116 versus R480).

Table 4 shows a further sub-analysis by burn size. Observed differences in time to heal and healing rates did not reach statistical significance. In the large burn paediatric sub-group, the average cost per healed burn for the Biobrane group was less than half that of the Standard group (R146,974 versus R299,461).

IV. Discussion

Much of the published literature looking at Biobrane has conducted in a paediatric setting [7, 10]. We observed a small decrease in time to healing in Biobrane-treated patients in our paediatric sub-group, although this did not reach significance as reported previously [9]. The increased healing rates associated with Biobrane in the paediatric subgroup translated into 16% risk reduction in the development of an unhealed burn. Increased healing rates in our paediatric sub-group also contributed to the observed decreased decrease in cost per healed burn, another important consideration in our environment. This cost advantage was particularly noted in the large burn subgroup. Although LOS was decreased for children treated with Biobrane, this decrease did not reach significance and was not as large as might have been expected from other published studies. This is due in part to the challenging socio-economic circumstances facing many of our patients. Under normal circumstance we would discharge patients to out-patients follow-up as soon as the rate of burn wound healing allowed it, and certainly in patients where dressing changes were required to be performed every 3 days (as opposed to on a daily basis). Unfortunately during the course of the study we found that we were unable to discharge a number of these patients for follow up in the community, for reasons purely non-medical, and solely related to lack of social support structures. For this reason, we started to

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capture the date on which the reference wound was deemed suitable for management on an out-patient basis. Biobrane would appear to offer a significant advantage over Standard therapy in this regard in paediatric patients and we would therefore aim to record this parameter formally in future-planned studies.

The time to suitability for management of the reference wound on an out-patient basis was similarly significantly shorter for Biobrane-treated patients in the adult subgroup, this did not translate into a reduced or even comparable LOS cost when compared to Standard therapy-treated patients.

The fact that this group had higher ICU and high care costs may be related to the requirement for general anaesthetic for initial Versajet debridement, although the same trend was not observed in the paediatric population. A recent retrospective analysis suggests that in adults Biobrane may be better suited to extensive superficial burns, rather than smaller mid dermal or mixed depth burns [15]. Identifying burn depth with certainty on admission is an ongoing challenge to the burns surgeon – a number of burns we believed to be partial thickness on admission later revealed themselves to be full thickness, necessitating alternate treatment in both groups.

The increased mean number of surgical procedures for the Biobrane group was expected, given that the protocol called for all initial dressing changes to be done in theatre for this group. The significantly decreased number of dressing changes for the Biobrane group is in line with findings of other studies [10]. The associated decreased trauma is important, particularly for the paediatric population. Although not a significant cost-driver, the markedly reduced analgesic costs in all Biobrane-treated patients provide further evidence of this reduction in discomfort.

Pseudomonas infection is always of concern in the burns unit, and was noted on more than one occasion over the course of our trail. Although not the focus of our study, we did note that Biobrane use is incompatible with Pseudomonas infection, and a high level of suspicion for this organism is warranted in cases of non-adherence.

V. Conclusion

Although Biobrane and Acticoat did not lead to a significant decrease in time to healing when compared with Standard therapy, we believe the significant reduction in dressing changes observed for this regime to be important, particularly in children. Together cost reduction to treat and heal partial thickness burns, we recommend Biobrane and Acticoat be considered first line therapy in children with partial thickness burns, and have adapted our Standard of Care accordingly. In adults, although a significant decrease in dressing changes was observed, the increased costs associated with Biobrane and Acticoat suggest that it be considered only in carefully selected patients. Deep partial thickness burns has a poor outcome when Biobrane is used and prone to pseudomonas infection thus a superficial partial thickness burns will be more beneficial using this modern regime.We have concluded as well that reduction in analgesics and antibiotics used in Biobrane group reflects respectively reduction in pain and infection overall for these patients. Any new treatment for burns must always take in account the socioeconomic condition of the patient environment. In the future we need to evaluate if all patients need to be debrided in operating room prior to application of skin substitutes.

VI. Conflict of Interest Statements

No conflict of interest in the study.

VII. Acknowledgements

All nurses and doctors of Chris Hani Baragwanath Burns Centre who participated in dressing and assessment of wounds.

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Table 1 - Baseline characteristics.

		Overall (n=96)		Paediatric subgroup (n=45)		Adult subgroup (n=51)	
	Overall (n=96)	Standard therapy	Biobrane and Acticoat	Standard therapy	Biobrane and Acticoat	Standard therapy	Biobrane and Acticoat
		n=47	n=49	n=19	n=26	n=28	n=23
Age (median [IQR])	13.0 [2.6-29.2	23.2 [3.4-34.2]	6.6 [2.3-25.4]	2.7 [1.6-4.1]	2.3 [1.7-4.1]	29.6 [25.4-37.7	26.7 [19.2-37.7]
		Mann-Whitney: p=0.0984					
Gender (% [n])							
Male	53% [51]	49% [23]	57% [28]	42% [8]	54% [14]	54% [15]	61% [14]
Female	47% [45]	51% [24]	43% [21]	58% [11]	46% [12]	46% [13]	39% [9]
Overall % TBSA (mean [±SD])		20 [±6.6]	21 [±7.5]	21 [±7.1]	22 [±7.5]		
(median [IQR])	20 [15-25]					19 [15-22.5]	20 [15-24]
		2 sample t-test: p=0.5594		*2 sample t-test: p=0.9717*		*Mann-Whitney: p=0.7521*	
Reference wound % TBSA (mean [±SD])				13 [±3.6]	13 [±5.3]		
(median [IQR])		11 [10-13]	12 [9-15]			10 [9-12.5]	10 [8-14]
		Mann-Whitney: p=0.5086		*2 sample t-test: p=0.5933*		*Mann-Whitney: p=0.9848*	
Reference wound location (n [%])							
Anterior calf		1 (2%)	0 (0%)				
Anterior thigh		4 (9%)	0 (0%)				
Anterior trunk		22 (47%)	21 (43%)				
Anterior upper arm		5 (11%)	5 (10%)				
Posterior back		13 (28%)	21 (43%)				
Posterior buttock		0 (0%)	1 (2%)				
Posterior thigh		2 (4%)	0 (0%)				
Posterior upper arm		0 (0%)	1 (2%)				
Cause of injury (% [n])							
Scald	76 [79%]	32 [68%]	44 [90%]				
Fire	20 [21%]	15 [32%]	5 [10%]				

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Table 2 - Outcomes

Outcome	Overall (n=96)		Paediatric subgroup (n=45)		Adult subgroup (n=5
	Standard therapy n=47	Biobrane and Acticoat n=49	Standard therapy n=19	Biobrane and Acticoat n=26	Standard therapy n=28
Primary outcome					
Time to healing (days) (mean [±SD])			23.7 [±9.4]	21.7 [±9.0]	
(median [IQR])	19 [14-27]	20.5 [13-25]	*two sample t-test: p=0.5361*		18.5 [12-27]
	Mann-Whitney: p=0.9919				*Mann-Whitney: p=0.*
Healing rate (n [%])	78.7% [37/47]	81.6% [40/49]	68.4% [13/19]	84.6% [22/26]	85.7% [24/28]
	chi2: p=0.721		*chi2: p=0.197*		*chi2: p=0.487*
Secondary outcomes					
Cost to treat (mean [SD]) (ZAR)	67,529 [±69,294]	83,123 [±61,449]	98,470 [±76,335]	94,226 [±60,210]	46,534 [±56,261]
Average cost per healed burn per grou	85,780	101,826	143,917	111,358	54,290
Length of stay (median [IQR]) (days)	17 [12-25]	18 [10-26]	20 [14-34]	19 [13-35]	17 [10-20]
Surgical procedures (median [IQR])	0 [0-1]	1 [1-1]	1 [0-1]	1 [1-1]	0 [0-1]
Dressing changes (mean [±SD])			10.7 [±4.8]	7.6 [±4.8]	10.3 [±3.8]
(median [IQR])	10 [8-12]	5 [4-9]			
	Mann-Whitney: p=0.0001		*2 sample t-test: p=0.039*		*2 sample t-test: p=0.0*

Cost data are rounded to the nearest South African Rand (R).

Table 3 - Cost Drivers: average cost per subject (mean R [%])

Average cost per s	**Overall**						**Paediatric subgroup**						**Adult subgroup**			
	Overall (n=96)						Paediatric subgroup (n=45)						Adult subgroup (n=51)			
	Standard n=47	SD	%	Biobrane and n=49	SD	%	Standard therapy n=19	SD	%	Biobrane and n=26	SD	%	Standard n=28	SD	%	Biobrane and n=23
Theatre	2,884	4,915	4	10,538	2,556	13	3,124	4,817	3	9,773	2,125	10	2,722	5,061	6	11,403
Dressing changes	2,711	1,416	4	4,649	6,659	6	2,875	1,418	3	2,825	1,621	3	2,599	1,430	6	6,711
Length of stay	57,636	59,678	85	64,606	56,063	78	87,077	67,075	88	77,913	55,964	83	37,659	45,216	81	49,564
Anti-infectives	468	1,406	1	241	777	0	450	710	0	351	1,007	0	480	1,740	1	116
Analgesia	278	707	0	104	119	0	214	529	0	103	126	0	322	813	1	104
Investigations	3,140	3,448	5	2,705	2,126	3	4,237	4,427	4	2,781	1,841	3	2,396	2,403	5	2,620
Blood products	411	1,467	1	280	518	0	493	1,169	1	480	605	1	356	1,657	1	54
Total	**67,528**		**100**	**83,123**		**100**	**98,470**		**100**	**94,226**		**100**	**46,534**		**100**	**70,572**

Data are presented as means (SD), and rounded to the nearest South African Rand (R). Relative percentages are shown.

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Table 4 - Outcomes by burn size*

Outcome	Paediatric subgroup (n=45)				Adult subgroup (n=51)		
	Standard therapy (n=19)		Biobrane and Acticoat (n=26)		Standard therapy (n=28)		Biobrane ar (n=
	Large burns (n=8)	Small burns (n=11)	Large burns (n=12)	Small burns (n=14)	Large burns (n=4)	Small burns (n=24)	Large burns (n=4)
Primary outcome							
Time to healing (days) (median [IQR])	25 [18.5-33]	20 [17-26]	23 [13-23.5]	22 [16-23.5]	38 [34-42]	17.5 [12-23]	21 [17-25]
Healing rate (n [%])	50% (4/8)	82% (9/11)	83% (10/12)	86% (12/14)	50% (2/4)	92% (22/24)	50% (2/4)
Secondary outcomes							
Average cost per healed burn per group (ZAR)	299,461	74,786	146,974	81,679	244,940	36,957	288,177

*Paediatric group: large burn > 20% TBSA, Adult group: TBSA > 25%
**Cost data are rounded to the nearest South African Rand (R).

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Prediction of Difficulty of Laparoscopic Cholecystectomy by Preoperative Ultrasonography: A Randomized Control Trial

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Abstract- The aim of this study was to determine whether the preoperative USG finding can predict the difficulty during the laparoscopic cholecystectomy and its conversion. 500 patients undergoing Laparoscopic cholecystectomy at Sawai Mansingh Medical College and attached Hospital were included. Sonographic parameters like Gall Bladder wall thickness, antero posterior diameter of Gall Bladder in fasting state, impacted gall stone, CBD diameter were taken into consideration and difficulties in terms of time taken for surgery, cystic duct injury; cystic artery injury and lead to conversion were analyzed. Of the 400 cases, 24 (6.0%) were converted to open procedure. Of the 144 (36%) cases predicted to be difficult, 116 (29%) were technically difficult, of which 18 (4.5%) were converted to open procedure. Of the 256 (64%) cases predicted to be easy on ultrasonography, 19 (4.75%) were found to be difficult on surgery, of which only 6 (1.5%) had to be converted to open procedure. In univariate analysis all the sonographic parameters we had included in this study were statically significant (p value <0.05).

Keywords: gall bladder, cholelithiasis, ultrasonography, laparoscopy, cholecystectomy.

GJMR-I Classification: NLMC Code: WN 208

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Prediction of Difficulty of Laparoscopic Cholecystectomy by Preoperative Ultrasonography: A Randomized Control Trial

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Abstract- The aim of this study was to determine whether the preoperative USG finding can predict the difficulty during the laparoscopic cholecystectomy and its conversion. 500 patients undergoing Laparoscopic cholecystectomy at Sawai Mansingh Medical College and attached Hospital were included. Sonographic parameters like Gall Bladder wall thickness, antero posterior diameter of Gall Bladder in fasting state, impacted gall stone, CBD diameter were taken into consideration and difficulties in terms of time taken for surgery, cystic duct injury; cystic artery injury and lead to conversion were analyzed. Of the 400 cases, 24 (6.0%) were converted to open procedure. Of the 144 (36%) cases predicted to be difficult, 116 (29%) were technically difficult, of which 18 (4.5%) were converted to open procedure. Of the 256 (64%) cases predicted to be easy on ultrasonography, 19 (4.75%) were found to be difficult on surgery, of which only 6 (1.5%) had to be converted to open procedure. In univariate analysis all the sonographic parameters we had included in this study were statically significant (p value <0.05). This study concluded that Preoperative sonographic signs can predict the difficulty in laparoscopic cholecystectomy.

Keywords: gall bladder, cholelithiasis, ultrasonography, laparoscopy, cholecystectomy.

I. Introduction

Mouret performed the first laparoscopic cholecystectomy (LC) in 1987 in France. Now for symptomatic cholelithiasis LC is considered as GOLD STANDARD surgery. Cost effectiveness, quick recovery and consumer satisfaction (patient acceptance) are the major criteria for the procedure of choice for any disease. Though set up and instrument are more expensive for LC, but earlier return to work and the shorter hospital stay make the procedure more cost effective.[1-4] Patient satisfaction is indeed higher with LC. Thus performance of LC enables hospitals to treat more patients of gall stone disease at a lower cost, with better patient satisfaction as compared to OC. Many centers now perform LC as a day care operation and almost all centers discharge patients on the first post- operative day. Difficulty faced during operation may require relative or emergency conversion to open procedure or laparotomy. Thus, pre-operative prediction of difficulty in operation and the risk to conversion is an important aspect of planning laparoscopic surgery. With the help of accurate prediction, high risk patients may be informed beforehand and they may have a chance to make arrangements regarding their professional and family commitments. The surgeons also may have to schedule the time and the team for the operation appropriately. Patients predicted to have a high risk of conversion or difficulties in operation have to be operated on by an experienced team these patients are not suitable for resident training. When operating on a high risk patient there should be a low threshold for conversion, because early conversion shortens the operating times and decreases morbidity.[6-9] Patient selection is very important for day care procedures, and low risk patients have to be selected.[5,11,12] Patients predicted to have high risk have to be scheduled for longer hospitalization and more intensive facilities. Hospitals have to plan admissions and bed vacancy accordingly. Ultrasonography is the most common screening test for cholecystitis and cholelithiasis. It is easy, non invasive, safe and a highly accurate imaging technique. It detects gallstones with accuracy of more than 95%. Several studies have been carried out to assess the risk of conversion preoperatively. Kama et al conducted retrospective study.[10] Many studies have found thickened gall bladder wall in USG to be an accurate predictor of difficulties that might be faced during LC.[10,11,12] This is despite the fact that ultrasound is a highly observer dependent investigation. While most of the previous studies in the literature were retrospective and evaluated various risk factors in terms of conversion to OC, our is a prospective study analyzing these risk factors as preoperative predictors on USG not only for conversion of LC to OC but also for anticipating difficulties in LC.

II. Materials and Methods

This study was conducted on patients undergoing laparoscopic cholecystectomy in Department of S.M.S Hospital & Attached Group of Hospitals, Jaipur, India.

Patients of all age group and both sex with symptomatic Gall stone disease were included in study.

Exclusion criteria included pregnancy, conversion to open procedure due to equipment failure,

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any emergency surgery like gall bladder perforation, patient's refusal to give informed consent, choledocholithiasis, presence of jaundice and abnormal liver function tests, suspected malignancy with cholelithiasias. The ultrasonography was done using standard B mode, gray scale, and real time scan with 3.5 MHz probe. Equipment used for laparoscopic cholecystectomy were video equipment, laparoscopic instruments used in conventional laparoscopic cholecystectomy, energy source- endocoagulators and diathermy unit (monopolar/ bipolar) and stop watch.

All patients included in the study underwent detailed history taking and clinical examination. All routine investigations including liver function test and coagulation profile were done. Pre-operative ultrasound was done for all patients and following criteria were assessed :- Gall Bladder wall thickness- more than or less than 3 mm, Antero Posterior Gall Bladder diameter in fasting state-less than 3 cm and more than 5 cm, Impacted gall stones, CBD diameter- more than or less than 6 mm.

The selected patients were then told about the procedure and written informed consent was taken. Patients were also informed about the conversion to open cholecystectomy.

Standard four port technique with patient in American position was used for laparoscopic cholecystectomy. Intra-operatively following criteria's were assessed: - Duration of surgery from the insertion of Veress needle to the extraction of gallbladder more than or less than 90 minutes, Spillage of bile and stone present or not, injury to duct, cystic artery and any other complication during surgery. Procedure was defined as easy or difficult based on following criteria:

Easy and difficult criteria

Easy	Difficult
Time taken < 90 min No bile/stone spillage	Time taken ≥90 min bile spillage/stone spillage
No injury to duct, artery	injury to duct and artery
Easy access to peritoneal cavity	Difficult access to peritoneal cavity
	Conversion to open procedure

Reasons for conversion:-Difficult dissection (adhesions at Calot's triangle), Unclear anatomy (short cystic duct, dilated cystic duct), Injury to biliary tract or other viscera, Bleeding during dissection.

III. Results

The study was conducted in a total of 400 patient's age between 17 to 75 years. After proper evaluation and assessment, all patients were planned for laparoscopic cholecystectomy.

a) Age Distribution

The age group of the patients ranged from 17 to 75 years with mean age 40 years. The maximum incidence was seen in the age group of 30- 35 years. +

b) Sex distribution

The female to male ratio was 2.6: 1. The above sex distribution shows that the gall bladder diseases have a higher frequency in females than in males in all age groups.

c) Gall bladder wall thickness

The maximum gall bladder wall thickness was found to be 6mm and minimum 1.6mm with mean thickness 2.4mm. There were 156 (39%) patients with gall bladder wall thickness more than 3mm.

d) Contracted (≤ 3cm)/distended (≥ 5cm) gall bladder

There were 144 patients (36%) with contracted/distended GB. The remaining 256 patients had gallbladder of normal volume.

e) Stone impacted at the neck of Gall bladder

There were 88(22%) patients with gall stone impacted at the neck of gall bladder or Hartman's pouch. The rest of the 312 patients had mobile gall stones. The patients with gall bladder full of stones with no mobility of the stones due to gallbladder being totally packed with stones was taken as stone impacted at the neck of gall bladder.

f) Common bile duct dilatation more than 6mm

There were only 12 (3%) patients with common bile duct diameter more than 6mm. This could be due to the reason because the patients with common bile duct stones were excluded from the study.

g) Prediction of the difficult cases on Ultrasonography

The total number of cases predicted to be difficult on ultrasonography was 144 patients (36%).The remaining 256 cases (64%) were predicted to be easy.

h) Total number of difficult laparoscopic surgeries

The total number of laparoscopic cholecystectomy attempted was 400 out of which 135 (33.75%) were found to meet the difficulty criteria. The remaining 265(66.25%) cases were easy on laparoscopic cholecystectomy.

i) Conversion to open cholecystectomy

Out of total 400 cases 24 (6.0%) cases were converted to open procedure. In the remaining 376 cases the laparoscopic cholecystectomy was completed successfully (including the difficult cases which were not converted to open cholecystectomy). The various reasons for conversion were 20 (5.0%) cases due to dense adhesions in the calot's triangle, and gallbladder with the surrounding viscera that is colon and omentum and bleeding due to tear of cystic artery, 3 (0.75%) cases due to gangrenous GB one case (0.25%) due to cholecysto-colic fistula.

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Table1 : Correlation of ultrasonographic prediction and difficulty in performing laparoscopic cholecystectomy and conversion to open procedure (Table 1)

	No of cases difficult on surgery	No of cases found to be easy during surgery	No of cases converted to open surgery	No of cases not converted to open surgery	Total
NO of cases predicted to be difficult in USG	116	28	18	126	144
NO of cases predicted to be easy in USG	19	237	06	250	256
Total	135	265	24	376	400

Sensitivity of ultrasonographic prediction = 85.92%
Specificity of ultrasonographic prediction = 89.43%
Positive predictive value (of cases to be difficult on ultrasonography) = 80.55%
Negative predictive value (of cases to be easy on ultrasonography) = 92.57%
Percentage of false negative = 14.07%
Percentage of false positive tests = 10.56%

Sensitivity of ultrasound to predict the conversion to open procedure was = 75%.
Specificity = 66.48%,
Positive predictive value = 12.5%.
Negative predictive value = 97.65%
Percentage of false negative was = 33.33%.
Percentage of false positive tests was =33.51%

Table 2 : Correlation between the gall bladder wall thickness and difficulty in the laparoscopic surgery and conversion to open surgery (Table 2)

	No of cases difficult on surgery	No of cases easy on surgery	No of cases converted to open surgery	No of cases not converted to open surgery	Total
NO of cases with GB wall thickness > 3mm	102	54	16	140	156
NO of cases with GB wall thickness < 3mm	33	211	08	236	292
Total	135	265	24	376	400

Sensitivity of gall bladder wall thickness to predict difficulty in laparoscopic surgery was 75.55%,
Specificity 79.62%,
Positive predictive value 65.38%,
Negative predictive value 86.47%

Sensitivity of gallbladder wall thickness to predict the conversion to open cholecystectomy was 66.66%,
Specificity 62.76%,
Positive predictive value 10.25%,
Negative predictive value 96.72%

Table 3 : Correlation of the gall bladder diameter and difficult cholecystectomy and conversion to open surgery (Table 3)

	No of cases difficult on surgery	No of cases easy on surgery	No of cases converted to open surgery	No of cases not converted to open surgery	Total
No of cases with contracted and distended GB	98	46	14	130	144
No of cases without contracted and distended GB	37	219	10	246	256

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Total	135	265	24	376	400

Sensitivity of contracted gall bladder to predict the difficult laparoscopic cholecystectomy was 72.59%,
Specificity 82.64%,
Positive predictive value 68.05%,
Negative predictive value 85.54%, and

Sensitivity of contracted gall bladder to predict conversion to open cholecystectomy was 58.33%,
Specificity 65.42%,
Positive predictive value 9.72%,
Negative predictive value 96.09%

Table 4 : Correlation of the Impaction of stone in the gall bladder neck with the difficult laparoscopic cholecystectomy and conversion to open surgery (Table 4)

	No of cases difficult on surgery	No of cases easy on surgery	No of cases converted to open surgery	No of cases not converted to open surgery	Total
No of cases with impaction of stone at neck of GB	50	38	13	75	88
No of cases without impaction of stone at neck of GB	85	227	11	301	312
Total	135	265	24	376	400

Sensitivity of stone impaction at the neck of gall bladder to predict difficult laparoscopic cholecystectomy was 37.03%,
Specificity 85.66%,
Positive predictive value 56.81%,
Negative predictive value 72.75 and

Sensitivity of the impaction of stone at the neck of gall bladder and conversion to open cholecystectomy was 54.16%,
Specificity 80.05%,
Positive predictive value 14.77%,
Negative predictive value 96.47%.

Table 5 : Correlation of Ultrasonographic prediction with difficulty in performing laparoscopic cholecystectomy and conversion to open surgery (Table 5)

USG parameter	Difficult/ open	Sensitivity	Specificity	PPV	NPV
Combined	Difficult	85.92	89.43	80.55	92.57
	Open	75	66.48	12.5	97.65
Wall thickness	Difficult	75.55	79.62	65.38	86.47
	Open	66.66	62.76	10.25	96.72
Contracted GB	Difficult	72.59	82.64	68.55	85.54
	Open	58.33	65.42	9.72	96.09
Impacted stone	Difficult	37.03	85.66	56.81	72.75
	Open	54.16	80.05	14.77	96.47

IV. Discusion

LC is the procedure of choice for symptomatic cholelithiasis.[16-18] The most common reasons for difficulty during LC are severe inflammation, dense adhesions and bleeding.[6] Severe inflammation and high vascularity as in the case of acute cholecystitis, lead to difficulty in defining the anatomy of Calot's triangle and is associated with increased risk of bleeding. Besides this, impacted stone at the neck may be associated with difficulty in gripping the inflamed and friable gallbladder. Dense adhesions also make it difficult to define the anatomy of the Calot's triangle. Separation of a gall bladder from the GB fossa is also more difficult in such patients.

Prediction of difficulty in laparioscopic cholecystectomy can be made reliably If the surgeon has the benefit of accurate preoperative predictive factors. Advantages of accurate prediction of difficulty in LC include appropriate patient information, adequate surgeon preparation and proper operation scheduling, efficient hospital admission and bed usage and administrative planning and selection of patients for surgeons in the early learning phase and resident training.

Appriate patient information and preoperative counseling regarding difficulty in surgery and chances of conversion to open allows the patient to make a better informed decision about the surgery.

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Similarly, prediction of difficult laparoscopic cholecystectomy preoperatively leads to better preparation on behalf of surgeon for a challenging procedure and chances of conversion. Early conversion in such patients is proved to decrease postoperative morbidity.[1, 6, 8] Difficult operation can also be scheduled early in the operation theatre day. Such patients should be operated by more experienced surgical team. Also surgeons in the early phase of their learning curve should refer such patients to more experienced centers.

Several studies have been done to asses predictive factors for conversion of LC to OC. Our study has assessed risk factors for difficulty in LC also. Conversion has been included as one of the criteria for difficulty. In most previous studies adhesions, unclear anatomy and bleeding have been found to be the major factors necessitating conversion to OC. In their study of 628 patients posted for elective LC, Sanabaria et al, had to convert 32 patients to OC.[6] In our study, dense adhesions causing problems in dissection, defining anatomy, spillage of bile and stone and bleeding have been taken as criteria for difficulty. In addition increased operating time and conversion have been taken as criteria for difficult LC.

Daradkeh et al studied the overall difficulty scores (ODS) of LC.[14] and found that "gall bladder wall thickness and CBD diameter were found to be significant predictors of ODS." Some studies found distended gall bladder as the major predictor of conversion while others have implicated a contracted gall bladder.[13, 15]

a) Gall bladder wall thickness

In our study, thickened gall bladder wall was found to be a significant predictor of difficulty in LC ($p<0.001$). Thickened gall bladder wall was significantly associated with adhesions ($p<0.002$), bleeding ($p<0.0001$), and increased operating time ($p<0.0001$). Out of 24 patients who were converted, 16 have thickened GB wall. According to Fried et al patients with thickened gall bladder wall have 8 times more chances of conversion to OC.[5] They have associated a thickened gall bladder wall with difficulties in exposure of biliary anatomy. "These factors contributed to difficulties in retraction and increased chances of liver tears and bleeding from gallbladder bed, thus causing increased bleeding in these patients. A consequent increase in operating time was also noticed."

b) Gall bladder diameter

Gall bladder size also predicted difficult LC in our study. Gall bladder transverse diameter was found to be significant as a predictor of a difficult LC ($p=0.0060$). This is in accordance to Velden et al findings.[15] Their study however, was a retrospective study. Difficulties were encountered when a distended gall bladder was associated with a large stone impacted at the neck or a thickened gall bladder wall. A contracted gall bladder on ultrasound examination (after overnight fasting) is associated with adhesions, problems of exposure and difficulty in separation of gall bladder from the liver. In a study conducted by Lal et al, contracted gall bladder was found to be one of the predictors for conversion of LC to OC.[13] Many others have identified a contracted gall bladder as a potential factor for conversion.[10, 19, 20, 21] In our study only increased operative time ($p=0.0042$) and adhesions ($p=0.0086$) were found to be significantly associated with GB transverse diameter. Bleeding ($p=0.0710$) were found to be statistically insignificant.

c) Impacted stone in GB

In our study impacted stone and certain complications have correlation, so this is a good predictor of conversion to the open procedure, which is contrary to the findings in other studies in which stone impaction is shown to have a moderate correlation.[1,9] The main difficulty with stone impacted at the neck or Hartman's pouch is that it hinders holding of the gallbladder during dissection, and also due to impacted stone, the gallbladder is distended with mucus forming the mucocele of the gallbladder, which is even more difficult to hold from the fundus. In our study only increased operative time was found to be significantly associated with GB transverse diameter with $p = 0.0035$. Presence of adhesions ($p=0.345$) and bleeding ($p=0.810$) were found to be statistically insignificant.

d) CBD diameter

Out of the four ultrasonic parameters studied common bile duct diameter more than 6mm, the number of cases in our study was not enough to give a significant statistical value. This is due to the reason that the patients with common bile duct stones were not included in the study.

e) Conversion

In our study 24 patients required conversion to open cholecystectomy. Thus a conversion rate of 6% was observed. This is in accordance with the conversion rates observed in most recent series (3 to 5%).[5, 10, 14]

Reasons for conversion in the 20 patients were dense adhesions and bleeding due to injury to cystic artery. In these patients had thickened gall bladder wall, impacted stone and abnormal GB diameter. The 3 cases were converted due to presence of gangrenous GB one case due to cholecysto-colic fistula.

Though, GB transverse diameter and thickened gall bladder wall and impacted stones in GB on preoperative ultrasound were found significant in univariate analysis, multivariate analysis concluded that only thickened gall bladder wall and GB transverse diameter were significant factors in prediction of a difficult LC and conversion to open.

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laparoscopic cholecystectomy in most of the cases. USG is most useful in providing accurate information on several parameters like gall bladder wall thickness, gall bladder size, CBD diameter and CBD stones, impacted stones and any anatomical variations of the biliary tract. Thick gall bladder wall is a finding which may show that more adhesions may be found during surgery. Common bile duct dilatation may give an idea about the possibility of common bile duct stones. The impaction of stone at the neck of gallbladder followed by the gallbladder wall thickness and contracted gallbladder were the most accurate predictors of the potential operative difficulty and conversion to open procedure. Thus a careful preoperative USG by an experienced radiologist using state of the art instrument is indispensible while planning a laparoscopic cholecystectomy.

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Snodgrass Hypospadius Repair, One Stage Urethroplasty for Mid-Shaft and Distal Hypospadias. Clinical Experience and outcome of 44 Patients

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Abstract- Background : Hypospadias is a common anomaly of male external gentalia. Most cases of hypospadias are distal type. Snodgrass procedure or tubularized incised plate urethroplasty has become the preferable and optimal treatment for primary and distal cases of hypospadias. The aim of this study was to study the effectiveness and evaluate the outcome of Snodgrass procedure presented for 44 patients with distal and mid-shaft hypospadias. Patients and method; from April 2011 to May 2014; 36 patients with distal hypospadias and 8 patients with mid-shaft hypospadias, (total 44 patients) had been submitted to corrective surgery foe their hypospdias by single stage Snodgrass TIP technique.

Keywords: hypospadias, snodgrass operation, tabularized incised plate urethroplasty.

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Abstract- Background : Hypospadias is a common anomaly of male external gentalia. Most cases of hypospadias are distal type. Snodgrass procedure or tubularized incised plate urethroplasty has become the preferable and optimal treatment for primary and distal cases of hypospadias. The aim of this study was to study the effectiveness and evaluate the outcome of Snodgrass procedure presented for 44 patients with distal and mid-shaft hypospadias. Patients and method; from April 2011 to May 2014; 36 patients with distal hypospadias and 8 patients with mid-shaft hypospadias, (total 44 patients) had been submitted to corrective surgery foe their hypospdias by single stage Snodgrass TIP technique. Results: mean age of patients and mean operative time in this study were 2.8±1.8, 52.7±9.4 respectively. The functional and cosmetic results were excellent. The overall complications rate recorded was 13.6%. Urethro-cutaneous fistula developed in 3 patients (6.8%), meatal stenosis occurred in 2 patients (4.5%) while wound infection and dehiscence noted in 3 patients. Penile torsion was not encountered in this study. Conc usion: Snodgrass TIP technique is the most preferable and reliable repair for most patients with primary and distal hypospadias cases. It is simple, safe, effective and versatile with excellent functional and cosmetic results. The compli ations rate is relatively low and acceptable.

Keywords: hypospadias, snodgrass operation, tabularized incised plate urethroplasty.

I. Introduction

Hypospadias is defined as abnormal ventrally placed external urethral meatus. It is typically consisted of three abnormalities. These are: first, ectopic site of urethral meatus, second, ventral curvature of penis, known as chordate and finally hooded foreskin resulting in excess foreskin on the dorsum of penis more than the ventrum [1]. Some or all of these abnormalities may occur. Hypospadius may occur in isolation, or be a part of sexual development disorders. It is very important to address the isolated cases of hypospadius than those cases associated with sexual developmental anomalies. [2]

Hypospadias are among the most common birth anomaly of male genitalia, second only to maldesended testes [3]. The incidence of hypospadius is approximately 1 of every 300 live male births and in some families with disorders of sexual differentiation, may be as high as 1 in every 80-100 lives male births. The incidence of hypospadias had been doubled over the last century mainly in the western countries [4].

The exact etiology of hypospadius is still unclear [5]. Many theories were put to explain the occurrence of hypospadius. These include increased level of androgens or estrogens during embryogenesis or could be a genetic component. The severity of hypospadius is different among patients. It classically classified as proximal, midshaft and distal [6]. With proximal hypospadius, the severity of chordee will be more than in distal hypospadias when the extent of chordee, if present, will be very minimal. Distal hypospadias represents the vast majority of the cases. Proximal hypospadias occurs in less than 10% of the cases [7].

Despite its etiology, the treatment of hypospadius in all cases is the same, which is surgical repair. There have been over 200 different operations for correction of hypospadias [8]. Most of these surgeries can be categorized into one to three types of surgeries. These include correction of chordee (orthoplasty), reconstruction of the missing piece of distal urethra (urethroplasty)and reconstruction of the ventral side of penis (meatoplasty and glanuloplasty). The most commonly practiced surgical procedures for hypospadias repair are MAGPI (Meatal advancement and glanuloplasty) for glanular hypospadias, Thiersch Duplay Mathieu, and Snodgrass (TIP procedure)[9]. In this study, we discuss and evaluate our experience regarding the functional and cosmetic outcomes of TIP repair (Tubularized incised plate) or Snodgrass repair done for 44 patients with distal and mid shaft hyospadias, in addition to the rate of main complications.

II. Patients and Methods

This is a prospective study conducted in one major hospital in Basra, Iraq from April 2011 to May 2014, in which 44 consecutive male children presented with primary hypospadias submitted to correction

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surgery for their hypospadias by Snodgrass TIP procedure. The age of these boy ranges from 8 months to 12 years, mean age2.8±1.8 years. The type and severity of hypospadias were assessed preoperatively. The vast majority of the hypospadias in this study were distal type (36 patients) and only 8 patients have midshaft hypospasias. All patients in this study were examined preoperatively for the presence of chordee which was further confirmed during surgical repair by inducing artificial erection. Primary hypospadias only were included in this study. Children with history of previous failed hypospadias corrective surgery, those with concomitant urogenital anomalies and history of prior circum cision were excluded. All the operations had been done by same surgeon. The hospital stay in this study ranged from 2 to 5 days (average 3.5 days). Patients after discharge were followed week after surgery, then every 2 weeks for the first 2 months and every month for the first year to assess the functional and cosmetic outcome and to detect any complications.

Operative technique

The operative procedure of Snodgrass TIP hypospadias repair can be summarized by the following steps: first, the appropriate set-up and fine instruments and equipment is essential to a successful hypospadias surgery. The main set-up and equipments include fine pickups and needle drivers such as a Castroviejo type, fine knife such as Weck knife, fine sutures such as 5-0, 6-0 Vicryl and PDS sutures and flexible feeding catheter of appropriate size.

The operation is carried out under general anesthesia. Initially, the penis is prepped and draped in sterile fashion. Adhesions between the dorsal hood and glans are broken down and re-prepped again with povidone iodine. The presence of significant chordee after the adhesion is taken down becomes clear and evident. The presence of significant chordee is usually caused by shortage of skin on the ventral side or it may result from fibrous band which extends from the base of the penis along the lateral side and rarely, due to urethral plate tethering the penis or due to corporal body disproportion. The first step in TIP Snodgrass procedure is to put a traction suture in the glans penis. Traction suture allows the penis to be placed on ample tension so the tissue can be divided accurately. After that, hypospadias repair is mapped out. The urethral plate is first mapped out, next, marking is extended proximally and laterally to form firlit collar, the marking is extended onto dorsum of penis in circumferential manner. A soft catheter is inserted through the ectopic urethral opening to visualize the location and quality of the urethral meatus.

The operation began by degloving of penis. The more distal portion of the urethral meatus is usually very hypoplastic. Therefore, the meatus has to be cut back to site of adequate corpos spongiosm tissue covering the urethra. Tourniquet is placed at the base of penis to control the blood loss for better visualization of surgical field. The tourniquet used is a rubber band placed over gauze to prevent excessive compression of the urethra but allow adequate haemostasis.

The next step of procedure is isolation of urethral plate by making a U-shaped incision using a very sharp and fine knife like a Weck knife extending along the edges of urethral plate to healthy skin 2 mm proximal to meatus and the incision should be made perpendicular to the urethral plate down into glans while the glans is placed on traction to allow for a straight and vertical incision rather than a skiving incision that may affect the quality of urethral plate. The incision of urethral plate should not be extended too distal in the glans as it may result in meatal stenosis. After the incisions are made on both sides of urethral plate, it is extended circumferentially on the dorsum of penis. The incision is carried along the firlit collar to develop 3mm mucosal cuff that can be re-approximated over the tubularized urethra and to give a penis a more normal circumcised appearance. The circumferential incision should be sharp and all subcutaneous tissue is left with the dorsal foreskin, so it will be harvested as a sub-dartos flap.

The process of dissection and degloving should be continued to the peno-scrotal junction both on the ventral and dorsal side. The urethra should be carefully seen during dissection to avoid its injury proximally.

Laterally, the fibrous bands, if present, must be taken down to correct the chordee. The presence of chordee is confirmed operatively by inducing artificial erection with normal saline infusion of corpus spongiosus.The incisions lateral to the urethral plate is deepened to form glans wings, which can be rotated ventrally and re-approximated and sutured in the midline.

Next in the procedure, is the tubularization of urethral plate which begins by making a midline incision in the urethral plate to increase the circumference and allow tubularization of the urethral plate easily with 6-0PDS or Vycril over appropriate size and flexible catheter, usually of 6 to 8 Fr. size. The midline plate incision should not extend beyond the mid of glans penis to avoid meatal stenosis and to give the neomeatus more vertical and slit-like shape. All sutures should be in subcuticular fashion to ensure good approximation and healing. The second layer of the dartos pedicle flap is then obtained from the subcutaneous tissue of the dorsal preputial skin and transported ventrally through a buttonhole in the dartos flap which is sutured over the neourethra.

Glans wings are then approximated for galnuloplasty. Lastly Byars flap is made for ventral skin cover with creation of midline skin raphe and the access skin is cut and trimmed to give the penis the circumcised appearance. At the end of the procedure, gauze dressing was applied. Catheter and dressing removed 7 to 10 days post-operatively.

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III. Results

All 44 patients underwent Snodgrass TIP repair. The positions of the ectopic urethral meatus were coronal in 15 patients, subcoronal in 21 patients and mid-shaft in 8 cases. Mean age in this study was 2.8±1.8 years. Chordee noted in 11(27.3%) cases. Mean operative time was 52.7±9.4 minutes (range from 40-85 minutes).

Table 1: Patients characters and site of ectopic urethral meatus among patients

Patients characters and site of ectopic urethral meatus	No	Mean, %
Patient age (mean)	8 months- 12 years	2.8±1.8 years
Presence of chordee	11	27.3
Coronal	15	34.1
Sub-coronal or distal	21	47.7
Mid-shaft	8	18.2

The functional and cosmetic results with a normal looking slit- like vertical shaped meatus at the tip of glans were achieved in all 44 patients. The overall complication rate in this study was 13.6 %(6 patients).

Urethrocutaneous fistula was recorded in 3 patients (6.8%) in this study. The location of these fistulas was midshaft in 2 patients and subcoronal (distal) in one patient. Reoperation was needed for only one midshaft fistula 3 months after the first surgery and the operation was successful with good results. The other 2 cases were managed conservatively by urethral dilatation and insertion of urethral catheter which was fixed and kept for 2 weeks and the fistula closed spontaneously.

Meatal stenosis in this study was occurred in 2 patients (4.5%) manifested as poor urinary stream 4 to 6 weeks postoperatively. These stenoses were managed conservatively by serial and regular dilatation of urethra and meatoplasty was not needed.

Skin dehiscence and disruption was recorded in 3 patients (6.8%), two of them was associated with fistula formation and one cases due to wound infection. The dehiscence however was small and partial and treated conservatively by treatment of associated fistula and infection.

Penile torsion was not encountered in any patients in this study. Regarding the cosmetic outcomes 3 months was very satisfactory. The external urethral meatus was vertical, slit-like and centrally located in all patients.

Table 2 : Operative details and overall complication rate among patients

Operative details	No	Mean ,%
Operative time	40-85 mints.	52.7±9.4 mints.
Hospital stay	2-5 days	3.5 days
Overall complications	6	13.6
Urethra-cutaneous fistula	3	6.8
Meatal steanosis	2	4.5
Wound dehiscence	3	6.8
Penile torsion	0	0
Position and shape of neomeatus.	Central, vertical and slit-like	100
Functional and cosmetic outcome	Very satisfactory-excellent	100

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IV. Discussion

Hypospadia is very common congenital abnormalties of external genitalia in males. The severity of this disorder varies among boys according to the position of ectopic urethral meatus, on which, it is mainly classified in to proximal, midshaft and distal types. About 90% 0f children have the distal type of hypospadias [10]. The surgical aims of any hypospadias surgery are complete straightening of penis during erection, creation of neourethra which should be hairless and of adequate size and lumen, slit-like, vertical and centrally located urethral neomeatus, urination with a straight normal flow, well aimed stream, cosmetically acceptable penile appearance and lastly the surgery should be with few complications [11]. More than 200 operations or their modifications had been described for correction of hypospadias but none of these operations have met the above criteria or considered as gold standared for all patients and for all types of hypospadias, thus hypospadias surgery still one of urosurgical dilemma [12].

The tabularized incised plate (TIP) repair was introduced by Snodgrass 1994[13]. It depends on previous principle of urethral plate tubularization which is known as the Thiersch-duplay operation. The main limitation of this type of hypospadias repair was the narrow width of the urethral plate, so that the urethral groove was not wide enough for insitu tubularization. The Snodgrass repair is based on the fact that the midline incision into the urethral plate will widen it sufficiently allowing for urethroplasty without stricture

Snodgrass TIP urethroplasty is a single stage corrective procedure with excellent short-term and long-term functional and cosmetic outcomes with relatively few complications [14].

The age of most patients in this study were below 3 years (mean age 2.8±1.8 years) which was comparable to the age reported by Saleem et al[15] and Anwar-ul-haq et al [16] and less than the age reported by Raashid H et al[17] in their comparative study of Snodgrass and Mathieus procedure for primary hypospadias repair. The position of ectopic urethral meatus was distal in the majority of our patients, 36 patients (81.8%) in this study presented with coronal and subcoronal (distal) type and only 8 patients presented with midshaft hypospadias. These findings were consistent with that recorded by Sugerman et al [18], Cheng et al [19] and Bath et al [20].

Chordee in this study was noted in 12 patients (27.3%). The degree of chordee, however, was minimal in all cases. Patients with severe chordee were not included in this study. The incidence of associated chordee with hypospadias was different in various similar studies. It ranged from 100% in the study of Tonvichien and Niramis [21] to 0% in similar study of Snodgrass procedure for various types of hypospadias conducted by Hombalkar et al [22]. The presence of chordee was noted in 19.9% in Singh et al study [23] and was recorded in 35% in Sweet et al series [24]. We believe that the peresence of severe degree of chordee is associated with increased risk of urethrocutaneous fistulas postoperatively and so, patients with such findings should be excluded for Snodgrass repair.

The complications of hypospadias surgery are not infrequent. These include urethrocutaneous fistula, meatal stenosis, urethral strictures, wound infection and dehiscence, penile torsion, and cosmetically unacceptable penile appearance. The most feared and undesirable complication is the formation of urethrocutaneous fistula.Selection of the patients is very important for successful hypospadias surgery. Since the introduction the principle of incising the urethral plate by Rich et al [25] in 1989, it was mostly used for distal type and less commonly the midshaft hypospadias for better cosmetic results of hypospadias repair. Snodgrass developed this procedure by extending the urethral plate incision from the ectopic meatus to the tip of the glans in order to construct a new urethra from the already existing urethral plate. Presently, this procedure has gained popularity and wide acceptance among surgeons for correction of distal type of hypospadias because of its simplicity, versatility, less complications rate,and reliability to form vertical slit-like meatus. Although this procedure can be applied for patients with proximal type of hypospadias, it is better to be avoided in these patients with proximal type and also in those with significant and severe chordee in order to decrease the incidence of complications.

The overall complications rate in this study was 13.6%. Certain precautions had been adapted in this study to decease the incidence of unwanted complications. These include: delicate and gentle tissue handling, preservation of periurethral vascular supply which is very essential for procedure success by avoiding the use of cautery, but instead, we applied a rubber tourniquet over a piece of gauze at the base of penis in order to achieve relatively bloodless field, avoidance any tension, usage of magnification loupe, the use adequate length and well vascularized dorsal subdartos to avoid tension and necrosis of the flap and the use of appropriate size and flexible catheter to stent the neourethra and prevent obstruction and stenosis. By using these measured in our series, we obtained satisfactory results and acceptable complications rate of 6 in 44 patients which was less than the complications rate reported by Shanberg et al[26] and Borer et al[27] which were 15% and 24% respectively.

The incidence of urethrocutaneous fistula after Snodgrass repair in this study was 6.8%. Zhou et al [28] recorded 12.5% urethrocutaneous fistula after Snodgrass TIP repair. The rate of urethrocutaneous fistula noted by Cheng et al[19] and Akmal et al[29]

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was ranging from 0.6% to 16% while Jayanthi VR [30] and Ikramuddin et al [31] reported a fistula rate of 1% and 2% respectively. Uzair M et al [32] reported post Snodgrass repair urethrocutaneous fistula rate of 9.6%.

It had been suggested that several factors affect the formation of urethrocutaneous fistula after hypospadias surgery. The main factors are the type of surgical procedure, patient age, severity of hypospadias, surgeon experience, tissue handling, presence and degree of chordee, and construction of waterproof urethroplasty. Snodgrass [13] has recommended two layer urethral palate closures to decease the fistula formation. He found that the incidence of urethrocutanous fistula decrease from 33% to 11% or even less when two layer urethroplasty was performed. Snodgrass also added that the incidence of fistula can be reduced to nearly 0% when the two layer urethroplasty was covered with a tunica vaginalis flap instead of dartos flap. Willcox et al [33] suggested in his study that the incidence if fistula formation will be reduced when a second layer of well vascularized pedicle subcutaneous layer from dorsal hooded prepuce to cover the neourethra.

Alsharbaini R et al [34] noted in his series of 320 cases of distal and midshaft hypospadias treated by Snodgrass urethroplasty that the rate of fistula formation is related to the extent of urethral plate incision with lower incidence of fistula in those patients in whom the the incision extended to mid-glans than in those patients with incision extended to tip of glans. On the other hand, Khairi A et al [35] showed in his series that the thickness of the flap was an important factor in fistula prevention. They found that the flap when thick, nontransparent, allowing bulky vascular flap to be laid over the neourethra decreased the incidence of fistula.

Perlumutter et al [36] have been suggested that age at operation has an effect on the development of fistula. He noted that the fistula formation was significantly lower in patients less than 6 months than in older patients. In our study, all children who developed urethrocutaneous fistula were more than 2 year old.

Meatal stenosis after corrective hypospadias surgery is usually due technical reasons. The incidence of meatal stenosis in this study was 4.5% (2 patients only) which was treated conservatively by regular dilatation. Snodgrass [7,8,13] recorded meatal stenosis rate less than 1% and the lumen of neourethra was adequate which allow the introduction of 10 Fr easily. O´Connor et al [37] reported a high rate of meatal stenosis in their similar study. About 21% of their patients developed meatal stenosis which required correction under general anesthesia. Bath et al [20] noted that 6% of their patients had meatal stenossis post Snodgrass repair. Raashid H et al [17] reported that meatal stenosis rate of 5.3% in their series of TIP hypospadias repair. Holland et al [38] in their study of 59 patients submitted to Snodgrass repair reported meatal stenosis rate of 5%in Gurdal et al [39] study of 70 patients, only one patient developed meatal stenosis who required meatomy.

Alshabaini R et al [34] and Khairi A et al [35] concluded that extending the plate incision to the neomeatus site is a predisposing factor for meatal stenosis. They found that when a shorter urethral plate incision to the mid-glans is adapted and when neomeatus was not included in the urethral plate incision, the rate of meatal stenosis will be reduced. Besides, the appearance of the neomeatus was cosmetically better as vertical slit-like shape.

The rate of urethral stricture reported by many authors {7,40,41,42,43,44] after Snodgrass repair were low. The longitudinal incision in the urethral plate described by Snodgrass is important invention of hypospdias corrective surgery. It permits urethral plate preservation and facilitate the formation of tension free tubularization of narrow urethral plate to form a neouretha of good size. The low rate of urethral stricture after Snodgrass operation could be explained according to Bluestein et al [45] by the fact that the healing of midline incision of urethral plate occurred by re-epitheliazation with normal tissue in-growth without scaring or stricture. Snodgrass had shown in his series that the re-epithelization occurs by second intention after incision of urethral plate, so that the meatal stenosis and urethral strictures is unlikely to occur after TIP repair especially for distal type of hypospadias.

Penile torsion was not recorded in our study. This could be explained by the fact that patients with sever chordee were excluded. The chordee in our patients was absent or of minimal degree. Other factor which prevents the development of torsion was the way by which the dorsal preputial flap is transferred ventrally. This way entailed formation of window in the midline of the flap through which the penile shaft transferred to pull and transfer the dartos flap ventrally over neourethra. The rates of penile torsion in Al-Hunayan et al [46] and Soygur et al [47] studies of Snodgrass TIP repair were similar to our results. The extent effect of penile degloving on the rate of penile torsion is an issue of controversy. Degloving in our study was complete and extended to penoscrotal junction and induction of artificial erection was done to prevent postoperative torsion. Same trend was recommended by Snodgrass [13] and Sozubir [48], while Turialis et al [49] advised limited extent of degloving to decrease the length of the covering dorsal flap of the neourethra.

The functional and cosmetic results of Snodgrass repair in our study were excellent (100%). Re-operation was needed for one patient only who developed wound dehiscence and fistula formation. Our results were in agreement with those of Bath et al [20], Jayanthi VR [30], and Stehr et al [50]. There are two important criteria in order to obtain good functional and cosmetic results: the urethra plate should not be less

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than 1 cm wide and there should be no associated severe chordee. Furthermore, the cosmetic and functional results in a study conducted by Abolyosor [51], all 156 boys with distal and midshaft hypospadias repaired by Snodgrass repair had satisfied with the cosmetic and functional outcomes. Aslam R et al [52] who conducted a single-stage Snodgrass hyposadias repair for 74 patients with distal hypospadias recorded that only 2 patients showed residual bulkiness of skin around the corona with additional 2 patients developed meatal stenosis but with no functional symptoms.

Lastly, several studies were conducted to compare between Snodgrass and Mathieu technique regarding the outcomes and complications. Anwar-ul-haq et al [16], Oswald J et al [41], Guo Y et al [53], Hashem M et al[54] and Moradi M et al [42] noted that in their comparative studies that Snodgrass repair technique were superior on Mathieu technique, while in other 2 studies done by Germiyanoglu C et al [55] and Ververidis M et al [43]showed no difference between the two techniques in respect to complications but the cosmetic and functional results were better In Snodgrass repair.

Table 3 : Litriture reviews of Snodgrass repair for distal and midshaft hypospadias

Operative outcomes / Literature	Sample size No	Mean age (months)	Overall complications (%)	Fistula formation (%)	Meatal stenosis (%)	Shape of neo-meatus	Cosmesis outcome
Samuel [4]	65	14 m.	6	5	0	Slit-like	Excellent
Anwar-ul-haq [16]	45	36 m.	5	0	3	Slit-like	Excellent
Cheng[19]	414	_	0.2	0	0.2	Slit-like	Excellent
Rashid [17]	52	6.2 y.	11.5	5.76	5.3	Slit-like	Good
Bath[20]	16	2.6	12	6	6	Slit-like	Excellent
Jayanthi [30]	110	9.5m.	2	0.9	0	Slit-like	Excellent
Alsharbaini[34]	320	18m	14.1	2.5	3.1	Slit-like	Excellent
Moradi [42]	33	7.06	12.6	13.3	6.6	Slit-like	Excellent
Sozubir [48}	75	20	4	4	0	Slit-like	Excellent
Aslam[52]	74	3.5y.	7	2.7	2.7	Vertical	Good
Gue [53]	36	_	22.2	8.3	5.6	Vertical	Good
Ours	44	2.8	13.6	6.8	4.5	Slit-like	Excellent

V. Conclusion

Since the introduction of Snodgrass tabularized incised plate urethroplasty in 1994, this operation had gained a wide acceptance and popularity. It is simple, versatile and effective corrective surgery for patients with distal and mid-shaft hypospadias which constitute the vast majority of patients. The functional and cosmetic results of this technique which are the main concern to parents and patients are usually excellent. The rate of the main postoperative complications, namely, urethra-cutaneous fistula and meatal stenosis is usually low and acceptable. We advise Snodgrass TIP repair as first choice operation for all boys with distal and mid-shaft hypospadias.

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It is mandatory to read all terms and conditions carefully.

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Institutional Fellow of Open Association of Research Society (USA) - OARS (USA)

Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

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After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.

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We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

Other:

The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone. "

Process of submission of Research Paper

The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

(II) Choose corresponding Journal.

(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

(B) If you are using Internet Explorer, then Direct Submission through Homepage is also available.

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Offline Submission: Author can send the typed form of paper by Post. However, online submission should be preferred.

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MANUSCRIPT STYLE INSTRUCTION (Must be strictly followed)

Page Size: 8.27" X 11'"

- Left Margin: 0.65
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- Top Margin: 0.75
- Bottom Margin: 0.75
- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

You can use your own standard format also.
Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

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1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

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All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

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To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5.STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Abstract, used in Original Papers and Reviews:

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Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

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Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

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Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

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Acrobat Reader will be required in order to read this file. This software can be downloaded

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Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

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TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

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15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

Index

A

Adhesions · 30
Aureusbacteraemia · 7

B

Bacteraemic · 6
Baragwanath · 16
Biobrane · 1, 9, 10, 11, 12, 13, 15, 16, 19, 20, 21

C

Cartotto · 6
Cholecystitis · 22, 25, 27
Cholecysto · 23, 26
Circumferentially · 30
Cisatracurium · 2
Cloxacillin · 2, 4, 5
Cotrimoxazole · 4

D

Daptomycin. · 7
Daradkeh · 26, 27
Defibrillated · 2

E

Embryogenesis · 28
Epidemiol · 6, 7
Epithelialisation · 11
Escharectomy · 10

F

Fadeyibi · 4, 6

G

Germiyanoglu · 37
Glanuloplasty · 28
Glycopyrrolate · 2

H

Hydrosurgery · 10
Hypospadius · 28

M

Maldesended · 28
Melolin · 12
Midshaft · 28, 30, 32, 33, 34, 35, 37

N

Neomeatus, · 33
Niekerk · 19

O

Oosthuysen · 7

P

Pericarditis · 4
Piptaz · 2, 4, 5

R

Rennekampff · 20

S

Sanabaria · 26
Snodgrass · 1, 28, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41

T

Tachypnea · 4
Tazobactam · 2
Tenenhaus, · 20
Transesophageal · 4
Tubularization · 30, 33, 36

U

Urethrocutaneous · 34, 35, 40, 41

W

Witswaterstr · 11

Z

Zhongguo · 37

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