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EVALUATION OF RESULT OF ANTERIOR SUBCUTANEOUS INTERNAL FIXATION (INFIX) IN PELVIS FRACTURE

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ABSTRACT

Background
Pelvic anterior internal fixators (INFIX) are a relatively new alternative in the treatment of pelvis fracture. The aim of present study is to evaluate the result of Anterior Subcutaneous Internal Fixation (INFIX) in Pelvis Fracture.

Methods
The retrospective study was conducted at a tertiary care center among 56 patients of pelvic fracture treated with INFIX for duration of 2 years. The demographic information of the patients, the mechanism of injury, and any related injuries were recorded. The analysis of the data was done using descriptive statistics.

Results
The average age of the patients included was 38.59 years . 45 (80.3%) patients were male and 11 (19.6%) patients were female. Most frequently encountered mechanism of injury was road Traffic Accident (89.2%). The most common type of fracture was lateral compression (44%). The mean Iowa Pelvic Score of the study after removal was 86.43±2.90 (excellent).

Conclusion
A successful and safe treatment for unstable pelvic ring injuries is INFIX. Overall, patients have good outcome scores and tolerate the INFIX well. The primary issue is the high frequency of LFCN injuries, even if many of them were fixed once the INFIX was removed.

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Keywords: Complications, INFIX, Iowa Pelvic Score, Pelvic trauma, Pelvic ring injury.

INTRODUCTION

Pelvic fractures are frequently seen by large trauma centres and are linked to a high rate of morbidity in patients with multiple traumas. These typically arise from low energy trauma in osteoporotic bone in the elderly, or from high energy mechanisms such falls from a height or auto accidents. Although unstable fracture patterns typically require surgical fixation due to the high morbidity and mortality linked to pelvic fractures and the injuries they cause, stable fracture patterns are frequently treated non-operatively [1-3].

Since fixation results in hemostasis, external fixators are still regarded as the cornerstone of emergency care for pelvic ring fractures [4]. It stops more breakage of the fracture pieces and the soft tissue injury they cause.

Although there is no questioning the stability that plate fixation offers, it is advisable to avoid use in situations where there is a higher risk of infection, such as open wounds, infections, laparotomies, and suprapubic cystostomies performed for bladder injuries. Therefore, a minimally invasive fixation procedure was required that would be affordable, simple to replicate, and reduce mortality in patients with unstable pelvic fractures who also had an infection risk.[5]

Anterior pelvic rings are stabilised with the use of implants that are typically utilised in spinal fixation surgeries in the anterior subcutaneous internal fixation (INFIX) technique. M. Kuttner et al.[6] originally described it, using the phrase "pelvic subcutaneous cross over internal fixator." The implants are positioned subcutaneously, eliminating any potential for bacterial contamination as there is no contact with the intra-abdominal surgery site. The build is much more stable than external fixators because there is no extracorporeal component and the lever arm is shorter.

In a recent comprehensive analysis, Vaidya et al. [7] examined 496 patients who received INFIX treatment and discovered that the following side effects were noted: femoral nerve palsy (1%), heterotopic ossification (36%), infection and wound problems (3%), and lateral femoral cutaneous nerve (LFCN) injury/irritation (26.3%). Several authors have also noted loosening of the device and concerns about patient comfort.

There is currently little research on patient subjective follow-up using questionnaires on everyday function and activities after the INFIX is applied (and then removed). Hence the present study was done to evaluate the result of Anterior Subcutaneous Internal Fixation (INFIX) in Pelvis Fracture.

MATERIAL AND METHODS

The retrospective study was conducted at a tertiary care center among patients of pelvic fracture treated with INFIX for duration of 2 years. Ethical permission was taken from institutional committee before the commencement of study. As it was a retrospective study no need of informed consent from patients needed.

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Total number of selected patients was 56 on the basis of inclusion and exclusion criteria. The patients with age above 18 years with pelvic fractures and treated with INFIX and had data of atleast 6 months after removal of INFIX were included in the study. All the patients having any other fracture and below age of 18 years and lost follow up were excluded from the study.
The demographic information of the patients, the mechanism of injury, and any related injuries were recorded. Young and Burgess Classification [8] was used to classify the fractures. Prior to surgery, pelvic CT scans and AP, Inlet, and Outlet views of the X-rays were taken. The patients had pre-anesthetic examinations. It was recorded how long it typically took from admission to operation. The duration of the procedure (from incision to closure) and the volume of blood lost were the metrics recorded during the procedure.

Immediately following surgery, all patients had a colour doppler examination performed on both lower limbs to look for signs of vascular compression at 60, 90, and 120 degrees of hip flexion. Every patient received sufficient postoperative analgesia, and thromboprophylaxis was administered in cases deemed high risk based on the haematologist's assessment. Starting the next day, the patients were permitted to have both passive and assisted active hip flexion. First postoperative day pain was measured with the Visual Analogue Score. Patients were discharged from the hospital as early as the second day following surgery, depending on the related injuries and their ability to bear some weight while using a walker. After 14 days of operation, the stitches were taken out. The Iowa Pelvic Score was recorded at one and three months following surgery to assess the patients' functional condition, and serial radiographs were used to evaluate union. Patients were instructed not to lift anything heavy until they were joined. Following radiological union, an elective removal procedure was scheduled and carried out. Hospital records and inpatient charts provided the data that was gathered. The analysis of the data was done using descriptive statistics.

RESULTS

The average age of the patients included was 38.59 years . 45 (80.3%) patients were male and 11 (19.6%) patients were female. Most frequently encountered mechanism of injury was road Traffic Accident (89.2%) involving heavy goods vehicle and motorcycles. 10.8% of patients presented with a history of fall from height as shown in table 1.

Table 1 Demographic detail of patients with cause of accident

Variable		Mean±SD/ frequency (%)
Mean age (years)		38.56±6.78
Gender	Male	45 (80.3)
	Female	11 (19.6)
Cause of fracture	Road traffic accident	50 (89.2)
	Fall from height	6 (10.8)

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Out of 56 patients included 44% unstable lateral compression fractures (LC1, LC2 and LC3 injuries) making up the majority of cases, 28% vertical shear type fractures, 10% APC2 pelvic injuries, and 18% combined fracture types that were complex unstable injuries, often a combination of lateral compression and vertical shear that did not fit the Young and Burgess classification.

Table 2 Division of patients according to Young and Burgess Classification

Type of fracture	Frequency (%)
Lateral compression 1	6 (12)
Lateral compression 2	15 (26)
Lateral compression 3	3 (6)
Vertical shear	16 (28)
Anterior posterior compression 2	5 (10)
Combined mechanism	11 (18)

The mean operation time was 81.2±12.4 minutes, average loss of blood was 85.67±15.43 ml, fluoroscopy shots was 69.45±8.76 and mean number of hospital days was 26.34±4.36 as shown in table 3.

Table 3 Intraoperative parameters

Intraoperative parameters	Mean± SD
Operation time (minutes)	81.2±12.4
Blood loss (ml)	85.67±15.43
Fluoroscopy shots	69.45±8.76
Hospital days	26.34±4.36

The mean Iowa Pelvic Score of the study after one month was 65.78± 4.23 (fair), after 3 months was 78.43± 4.67 (good) and after removal was 86.43±2.90 (excellent) as shown in table 4.

Table 4 Iowa Pelvic Score of the study

Time of measurement	Mean score	Grade
After one month	65.78± 4.23	Fair
After 3 months	78.43± 4.67	Good
After removal	86.43±2.90	Excellent

The most common complication of INFIX insertion was LFCN injury which occurred in 15 patients. After removal, many of these resolved with 24% persisting at their most recent follow-up. 22% patients had evidence of heterotopic ossification and 4% patients had wound issues, being wound dehiscence and superficial infection. 18% had a venous thromboembolism (VTE) during their initial inpatient stay.

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Table 5 Complications before after insertion and removal of INFIX

Complications		Frequency (%)
After insertion	LFCN injury	15 (26.7)
	Venous thromboembolism	10 (18)
After removal	LFCN injury	13 (24)
	Heteroscopic ossification	12 (22)
	Wound issues	2 (4)

DISCUSSION

High-velocity traumas like pelvic fractures are usually linked to high-energy events, although low-energy traumas can also cause pelvic injuries, as evidenced by cases in the elderly population.[9] Patients with pelvic ring injuries can be treated utilising a variety of techniques, including open reduction, cortico-cancellous screw fixation, external fixators, internal fixation with plates, and a more recent technique called internal-external fixation.

The average age (38.56 years, with the majority of patients under 50 years old) and sex (80.3% male) of the patients in this study were comparable to those in the S Ghosh et al. publication.[10] In his investigation, he found that the average patient age was 37.27 years, with a majority of males. He came to the conclusion that males were more likely than females to drive under the influence, which may have contributed to this outcome. 89.2% of the patients experienced a traffic collision, and 10.8% had previously fallen from a height; in these cases, vertical shear fractures were more common. The remaining 44% of patients experienced lateral compression fractures. The current study's mean hospital stay of 26.34 days was longer than the 14.4 days reported by S. Ghosh.

The first set of INFIX results for 36 patients with Type C pelvic fractures (apart from symphysis rupture) according to the Tile classification was published by Müller et al. [11]. Each patient was only followed up for a period of 18 months, but throughout a 7-year period, they measured the clinical and radiological findings. A total of 31 patients (86%) were monitored until the study's conclusion.Within the perioperative period, three patients succumbed to multi-organ failure. Nine months on average after insertion was the time the INFIX was withdrawn. At the time of removal, thirty patients had a union of fracture. They observed that all patients had SF-12 scores that are noticeably lower than those of the general community at the time of the final follow-up.

Initial and mid-term results of using INFIX for pelvic injuries were published by Vaidya et al. [7]. Over a 7-year span, they saw 83 patients in total, with an average follow-up of 3 years.They included isolated symphyseal injuries, which we feel should be treated with open reduction and internal fixation, and Lateral Compression Type 1 (LC1) pelvic fractures, which are frequently thought of as a stable fracture pattern with a general agreement for non-operative care. Of their group, 25% were lost to follow-up, and an additional four patients died. Results from a multicenter trial involving 91 patients at four level-one trauma centres over a three-year

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period were also examined by Vaidya et al. [7]. It's possible that six patients underwent early revision surgery because they were unfamiliar with the device.

After surgery on the same day, we checked all patients with bilateral lower limb colour doppler to ensure sure the femoral vessels were not compressed. A Smith et al [12] reported the first case of vascular occlusion, in which the left leg began to mottle and immediately lost its pulse. As a result, he advised all surgeons to maintain the foot free of the surgical drape and to regularly check for triphasic arterial response using a doppler.

Patients with pelvic injuries are at risk for venous thromboembolism (VTE). In our study 18% suffered from VTE. Only 17% of individuals in R Steer's [13] study experienced VTE, which is much less than the 61% of patients described in other studies. He gave each patient a course of prophylactic low molecular weight heparin for a duration of 12 weeks. Patients at high risk received 40 IU of enoxaparin daily in the current trial. Patients with a history of VTE or AMI, those on OCP or HRT, those with a BMI greater than 29, and those who had undergone laparotomy, craniotomy, ICD implantation, with a lower limb fracture or open wound were among those in whom long-term immobilisation was anticipated. The haematologist advised switching to oral anticoagulant therapy, thus the treatment was continued until the patient was discharged or could walk around on their own. The INR was monitored during this time. Thromboprophylaxis was administered to 14 of the 18 patients. One patient had a type 2 GA wound that healed with primary intetion, and three other patients had several abrasions; in these cases, prolonged immobilisation was not envisaged.

The postoperative functional status was evaluated using the Iowa Pelvic Score [14]. The questionnaire consists of 20 questions about daily living activities that the patients must respond to. Work status, pain, visual pain line, limp, and cosmesis are all scored separately. The social and vocational situation of the patient is included. At the end of our study most patients had excellent score.

The present study has few noteworthy shortcomings. The small number of patients in the study group limited the applicability of the findings. The study did not include a control group. There was no way to measure the fluoroscopic radiation during surgery due to technical constraints. The results of the most recent INFIX implementation variations, such as Unilateral INFIX, Extended Unilateral INFIX, and Extended Bilateral INFIX, which have demonstrated strong biomechanical stability in in-vitro experiments, need to be further investigated.

CONCLUSION

With INFIX, patients can stabilise pelvic fractures with a less invasive procedure. It has a short learning curve and is readily replicable. Serious complications can be prevented with appropriate caution, and there are very few procedure-related complications. It seems like a reasonable substitute for external fixation in pelvic fractures.

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