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MID-TERM OUTCOMES OF OPERATIVE FIXATION OF TRAUMATIC PELVIC FRACTURES IN BRUNEI DARUSSALAM.

Lee Shi YEO[1], Toe Toe AUNG[1], Biju BENJAMIN[2], Dipo OLABUMUYI[1]
[1]Department of Orthopaedic Surgery, RIPAS Hospital, Bandar Seri Begawan, Brunei Darussalam.
[2]Department of Orthopaedic surgery, University College London Hospital, 235 Euston Rd, London NW1 2BU, United Kingdom.

ABSTRACT

Traumatic pelvic fractures are major bony injuries associated with long-term morbidity. We analysed the outcomes of operative repair of traumatic pelvic fractures secondary to road traffic accidents in our centre over a 11-years period. Majority of cases were B1 followed by C1 AO fracture pattern. Post-operative congruity was obtained in 95.2% of cases with a mean Majeed score of 92.4% at a minimum follow-up of four years. There was no statistically significant difference between the fracture groups and duration of hospital stay. Our results indicate that operative repair of traumatic pelvic fractures is associated with excellent outcome.

Keywords: Brunei, Fracture, Majeed score, Open fracture reduction, Pelvis, Road traffic accidents

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Traumatic pelvic fractures are major bony injuries associated with long-term morbidity. We analysed the outcomes of operative repair of traumatic pelvic fractures secondary to road traffic accidents in our centre over a 11-years period. Majority of cases were B1 followed by C1 AO fracture pattern. Post-operative congruity was obtained in 95.2% of cases with a mean Majeed score of 92.4% at a minimum follow-up of four years. There was no statistically significant difference between the fracture groups and duration of hospital stay. Our results indicate that operative repair of traumatic pelvic fractures is associated with excellent outcome.

Keywords: Brunei, Fracture, Majeed score, Open fracture reduction, Pelvis, Road traffic accidents

INTRODUCTION
Traumatic pelvic fractures are severe injuries, generally caused by high-energy mpact trauma, most frequently from road traffic accidents. This is associated with a high prevalence of poor functional outcome and chronic pain. It has been shown that there is an increase in long-term complications from stable type A injuries to completely unstable type C injuries.[1] While assessing the prognosis of pelvic injuries, long-term results should be analysed. There are reports in literature which suggest that patient function improves over the first 18 months.[2] But other authors have described a plateau in functional improvement between 6 months and 1 year post injury.[3]

Correspondence: Mr. Dipo Olabumuyi, FRCS(Ed), Department of Orthopaedic Surgery, RIPAS Hospital, Bandar Seri Begawan BA1710, Brunei Darussalam.
Telephone number: +6738670993; Fax Number: +6732424274; Email: dolabumuyi@yahoo.com

In Brunei Darussalam there is a rising incidence of road traffic accidents (RTA) casualties.[4] But there is currently no data available on the pattern of pelvic fracture injuries and long-term operative repair outcomes. This study aimed to analyze the patients admitted with pelvic fractures following involvement in a road traffic accident, who were operated in Brunei Darussalam with emphasis on radiographic and functional outcomes, and post-operative complications.

MATERIALS AND METHODS
Patients
This was a retrospective cohort study of all traumatic pelvic fracture cases that were operated on from 2005 to 2016 at Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital in Brunei Darussalam, which was carried out as part of our departmental audit into pelvic fractures management and outcomes.

Inclusion criteria were all cases of isolated traumatic pelvic fractures operated between this period at RIPAS Hospital. Patients with traumatic pelvic fractures and other associated injuries requiring prolonged treatment and hospital stay were excluded. Cases were identified from the operating theatre registry. In total, there were 26 cases of traumatic pelvic fractures following road traffic accidents that were operated on during the study period. However eight patients had other associated injuries that required prolonged hospital stay and treatment, hence they were excluded. Thus only 18 patients were included in the final analysis. Case records, radiographs and CT films of these 18 cases were analyzed. Demographic data, duration of hospital stay, days to surgery, and days to ambulation were the data extracted from the clinical notes. Pelvic fractures were classified according to the AO system and then clinically evaluated for functional outcomes.[5]

Operative approach and repair

All Type B fractures were reduced through Pfannenstiel incision with fixation carried out using AO 3.5 mm reconstruction plates and fixed superiorly or anteriorly over the pubic symphysis as previously described.[6]

Fractures of the pubic rami, or wing of the iliac bones were fixed according to the fracture patterns. Open reduction and AO 3.5mm reconstruction plate fixation were carried out for these injuries using the "appropriate windows" of the ilioinguinal approach for the injury as dictated by the fracture pattern.[7]

Type C unstable posterior fractures through sacroiliac joint (SIJ) were treated with open reduction using the posterior window of the ilioinguinal approach to access the SIJ anteriorly, taking care to preserve the lumbosacral nerve trunk. Appropriate sized 3 or 4 holes AO reconstruction plates were used to secure the reduction. Cases of SIJ joint disruption with moderate displacement were fixed percutaneously under image intensifier control, with AO 7.3 mm cancellous screws with washers. Parallel shorter plate (AO third tubular plate) were used to increase stability of the construct if required.[8-10]

Outcome measures

Patients were followed up with clinical examinations and radiographs for an average of 48 months after surgery. Post-operative radiographs were analyzed by two surgeons independently (TTA and DO) for congruency. We used the Majeed scores to assess the functional outcome.[11] The Majeed scores is a pelvic fracture specific functional assessment tool with a maximum of 100 points for patients working before injury or 80 points for patients not working before injury. The score items were pain (30%), return to work (20%), sitting disturbances (10%), sexual impairments (4%) and walking ability (36%). Walking ability was subdivided into use of walking aids (12%), analysis of unaided gait (12%), and the walking distance (12%). Patient who worked before injury were graded into excellent, good, fair and poor with score values of >85, 70–84, 55–69 and <55, respectively. Patients who did not work before injury were graded as excellent with a score >70, good with a score of 55-69, fair with a score of 45–54 and poor with a score <45.

Statistics

Continuous data were presented as mean and range, while nominal data were presented as percentage. Descriptive statistical analysis was carried out among the variables. We also used one-way analysis of variance (ANOVA) to explore for differences among the different types of fractures. A p value of <0.05 was proof of statistical significance.

RESULTS

The follow-up period ranges from 2 to 13 years. The mean age of the group was 34

Table 1: Fracture patterns and Inpatient statistics.

Fracture Pattern with numbers		Days to surgery	Days to ambulation	Total inpatient days
B1: 7		8	19	26
B2: 1		18	54	62
C1: 5		14	21	25
C2: 2		10	24	29
C3: 3		18	23	41
	SS	***df***	***MS***	***p***
Days to surgery between B and C patterns	86.0444	1	86.0444	F = 4.29685 *p* = 0.054695
Total inpatient days between B and C patterns	78.1723	1	78.1723	F = 1.478

years (Age range 20 to 55 years). Majority of the patients were male (83.3%) with a male to female ratio of 5:1. Majority were Malays (88.9%) with one Chinese and one foreign Philippine national. Based on the AO system of pelvic fracture classification, there were 7 cases of B1 injuries, 1 case of B2 fracture, 5 cases of C1 Fractures, 3 cases of C3 fractures and 2 cases of C2 fractures (Table 1). There were no cases of type A pelvic fractures in our series.

Operative management

All 8 cases of type B fractures were reduced and fixed using two AO 3.5 mm reconstruction plates, one fixed superiorly and the second fixed anteriorly over the pubic symphysis. Six cases of type C unstable fractures, posterior fractures through sacroiliac joint (SIJ) were fixed via open reduction using appropriate sized 3 or 4 holes AO reconstruction plates to secure the reduction. Two cases of SIJ joint disruption with moderate displacement were fixed percutaneously under image intensifier control, with AO 7.3 mm cancellous screws with washers. Two cases of type C pelvic injuries with associated U-shaped fracture of the sacrum had both anterior pelvic ring fixations as stated above, followed by posterior injury fixation through a midline incision from L4 to rima ani. The deep preparation elevates both erector spinae from lumbar spine, sacrum, and iliac crests on both sides. Laminectomy and nerve roots decompression were done for trapped nerve roots. With adequate reduction of fracture fragments, tension band plating of the posterior sacrum and iliac crest using long contoured AO 3.5 mm straight reconstruction plate spanning the posterior sacrum and both iliac crests were carried out. A second parallel shorter plate (AO third tubular plate) was needed to increase the stability of the construct at S3 level in one case.

Fracture types and length of hospital stay

In our series it was observed that B2 fracture patients had prolonged in-hospital stay ranging from 26 to 62 days, and most days to ambulation ranging from 19 to 54 days (Table 1). This was followed by the C3 pattern of injury with overall in-hospital stay ranging from 25 to 41 days and days to ambulation ranging from 21 to 24 days. However there was no statistically significant difference between the various fracture patterns (AO Type B versus AO Type C fractures) in the total length of hospital stay (Table 1).

Post-operative radiograph congruency, functional outcome and complications

The mean follow-up was 48 months. Figure 1 showed the post-operative radiograph congruency with good reduction achieved in 95.2% of the cases. The overall the Majeed score achieved was 92.4%, indicating excellent post -operative functional outcome for all patients. When this was broken down into the sub-

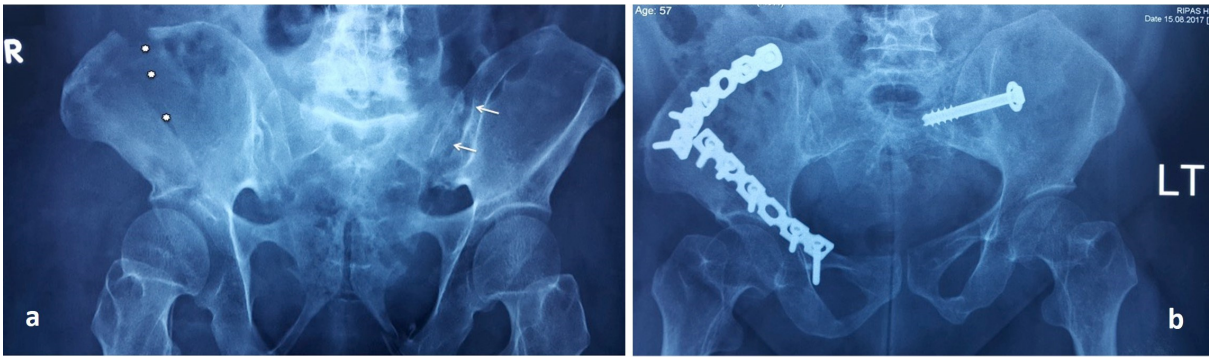

Figure 1: Fracture pelvis pre and post op radiographs demonstrating congruent reduction.

groups of fractures, Type B attained a score of 97% and Type C, 92%. There was only one post-operative complication of loosening of the SIJ plate.

DISCUSSION

Traumatic pelvic fractures with disruption of the pelvic ring are commonly cause by high impact energy commonly encountered in RTAs.[12] All 18 cases in our series were the result of RTAs. The incidence of pelvic fractures in trauma patients involved in RTAs has been reported to vary between 3% to 8% with instability of the pelvic ring seen in 13% to 17% of cases.[13] Because of the high impact energy involved, other associated injuries to the head, chest and abdomen are often present and about 14.2% of these patients with haemodynamic instability and pelvic fractures will succumbed to their injuries.[12]

There are growing evidences that operative repair with external fixation devices will stabilise and tamponade open pelvic fractures and hence reduce venous and bony bleeding. However, external frame does not permit early mobilisation without causing displacement of the fragments, especially those with vertical instability (Figure 1a). External fixators can be used in emergency situation to stabilise patients in the acute phase with formal open reduction and plate fixation carried out about 5-7 days post trauma when the patient general status allowed.

The classification of type B injuries includes anterior posterior compression injuries ("open book" injuries: B1, B3) and lateral compression injuries (B2). The latter seem to be less unstable and therefore potentially have a better long-term result with fewer patients complaining of pain.[1,14] Mardanpour et al in an analysis of 27 patients with type B injuries, reported a overall Majeed score of 81%, indicating good and excellent functional results of all cases treated with open reduction and internal fixation.[13] But only 48% of these patients were completely pain-free at follow-up. After B1 injuries, the overall functional result was graded excellent and good in 70–90%, when symphyseal plating was performed.[15] Thus the results of our small series is comparable to the larger series published internationally.

In Type C unstable fractures, the outcome of operative fixation is less satisfactory, although approximately an excellent or good overall functional result can still be expected in 70–80% of cases.[15] In terms of chronic symptoms, 30–50% of these patients may still complaint of significant persistent pain and have sexual or urogenital disturbances.

The commonest injuries requiring fixation in our series were Types B1 and C3. It has been previously shown that a residual displacement of >5mm at the posterior pelvis is associated with poor clinical outcomes[16,17]. Therefore, it is very useful to evaluate the

posterior pelvic ring at follow up by both conventional x-rays and CT scans. In our limited series, we were able to attain congruent reduction in 95.2% of the cases. Overall, our patients were able to achieve a Majeed score 92.4% in long-term functional outcome assessment.

Our results also indicate that among the fracture patterns, those with B2 and C3 fractures spent more days before mobilization and therefore more days in the hospital, but there was no statistically significant difference among the various fracture patterns.

Study limitations

There are several limitations in this study and the obvious ones are both retrospective design of the study and the small sample size of the cohort. Like most retrospective studies, searching and retrieving data poses a major challenge, in particular with missing data. However, in design of the study, we only aimed at collecting data field which were mostly recorded in the notes such as age, gender, length of stay, time to surgery, operative details etc. Furthermore, from 2013 onwards, with the introduction of Bru-HIMs national patients electronic medical record database, retrieving data was a lot easier. With regards to the small sample size, Brunei Darussalam is a small country of about 400,000 population. Hence this is likely to impact on the number of cases we see although RIPAS Hospital is the main tertiary referral centre of trauma and all cases would have been captured in our records and database.

CONCLUSION

The majority of pelvic fractures seen in our series following RTA were type B and C fractures. Open surgical reduction and fixation with plates and screws of type B and C pelvic fractures were associated with excellent functional outcome as indicated by an overall Majeed score of more than 92%, which is comparable to those reported in current literature. However these type of pelvic fracture injuries and their operative management are associated with prolonged in-hospital stay and delayed mobilization.

DISCLOSURE

All authors have contributed to the manuscript equally. None of the authors have direct or financial conflicts of interest.

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