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Research Paper

Fixation of Pelvic–Acetabular Fractures Using a Midline-Modified Stoppa Approach: Clinical and Operative Outcomes

採用改進Stoppa入路以下中線切口進行盤骨髖臼骨折：臨床和手術結果



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ABSTRACT

Background/Purpose: This served as the first report from our locality to evaluate the modified Stoppa approach, via a low-midline wound, for treating pelvic–acetabular fractures.

Methods: A total of 17 polytrauma patients with pelvic and/or acetabular fractures were consecutively treated using the modified Stoppa approach. They were followed up for at least 1 year postoperatively for radiographic and clinical assessments, which included the Modified Merle d'Aubigne Score, Harris Hip Score, and pain visual analogue scale.

Results: Among the 17 patients, 11 had pelvic ring fractures, two had isolated acetabular fractures, and four had a combination of both. Excellent and anatomical reduction was achieved in 73.3% of pelvic fractures and 71.4% of acetabular fractures. Functional outcomes simulated a bimodal distribution. Age of patient and Injury Severity Score were significant predictors for functional results, whereas fracture characteristics and quality of reduction were not correlated with clinical outcomes in this series. We experienced a low complication rate.

Conclusion: Excellent exposure for fracture reduction and fixation with low complication rate was achieved with the modified Stoppa approach. We were encouraged by the results of this preliminary series for treating pelvic–acetabular fractures in polytrauma patients.

中文摘要

背景/目的：這是以改進Stoppa入路以下中線切口進行盤骨髖臼骨折的本地首個報告。

方法：從2010年5月至2014年5月期間，採用改進Stoppa入路連續為17位病人治療其盤骨或髖臼骨折。隨訪至少一年，並紀錄影像結果和臨床成效。臨床評估包括改良Merle d'Aubigne評分、哈里斯髖關節評分和疼痛的視覺模擬評分。

結果：在17位病人當中，11位有盤骨骨折，2位有髖臼骨折，另外4位同時有盤骨及髖臼骨折。於73.3%的盤骨環骨折及71.4%的髖臼骨折，解剖復位達到優秀水平。而功能結果則呈現了雙峰的分佈。病人的年齡和創傷嚴重程度得分 (ISS) 能顯著地預測功能結果，而骨折特性和復位的準確度則與臨床結果沒有相關。術後的併發症比率偏低。

結論：改進Stoppa入路能做到優良的顯露，良好的骨折復位及低併發症比率。患有盤骨髖臼骨折的多發性創傷病人術後的初步成果，整體來說令人鼓舞。

Introduction

Since its first description by Cole and Bolhofner¹ in 1994, the modified Stoppa approach (or anterior intrapelvic approach) has gained popularity for fixation of acetabular and pelvic ring fractures over the past decade. Compared to the classical ilioinguinal

approach developed by Judet et al² in the 1960s, the modified Stoppa approach offers more direct access and visualisation of the pubis, the anterior column of the ilium, and more importantly, the quadrilateral plate of the acetabulum. It also simultaneously avoids dissection of the inguinal canal, femoral nerve, and external iliac vessels.³ The advantages are more obvious in patients with bilateral injuries.

Favourable results, in terms of both radiographic and clinical outcomes, with the use of the modified Stoppa approach have been increasingly described by the literature worldwide,^{4,5,6} including

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fellow traumatologists from Mainland China and other parts of Asia.^{7,8} However, there has not yet been any report from our territory evaluating the use of the anterior intrapelvic approach.

Patients with pelvic–acetabular fractures frequently suffer from hypovolaemic shock on arrival, as a result of profuse fracture bleeding into the pelvic cavity. A low-midline incision and subsequent retroperitoneal packing, with or without immediate upward extension for standard laparotomy as indicated, remains one of the standard measures to resuscitating these victims of high-energy trauma.⁹ As compared to the original Pfannestiel-type of incision,¹ reports on using this low-midline laparotomy wound to perform subsequent modified Stoppa approach for fracture fixation are limited.^{10,11}

The aim of this study was therefore to evaluate the midterm radiographic, functional outcomes and associated complications of pelvic–acetabular fractures fixed with the modified Stoppa approach, with a focus on patient demographics and fracture characteristics, as well as the need for additional surgical windows for definitive fixation. An attempt was also made to identify potential predictive factors for better clinical and operative results.

Methods

Between May 2010 and May 2014, a total of 17 consecutive patients with 18 pelvic and/or acetabular fractures (1 patient having bilateral involvement) received definitive fixation by the modified Stoppa approach. All of them were primarily admitted into a single trauma institute of the locality. A minimum follow-up period of 12 months postoperatively was required for every patient included.

Preoperative data including patient demographics, mechanism of injury, Injury Severity Score¹⁷ (ISS), and interval delay to definitive fixation surgery were recorded. Fracture pattern and characteristics were evaluated using a complete set of anteroposterior, inlet, outlet, and Judet radiographs, as well as computed tomography (CT) scans. Fracture types were first segregated into pelvic ring, acetabulum, or combined. Fractures of the pelvic ring were classified using the Tile system,¹² while acetabular fractures were described according to the Judet et al² classification.

All of our patients were polytrauma patients who suffered from high-energy injury. They all received retroperitoneal packing via a low-midline incision as part of the emergency life-saving treatment for their pelvic and/or acetabular fractures, as part of the management protocol of our institution. Subsequent definitive fixation surgery using the modified Stoppa approach was performed by one of the two senior authors. Perioperative data including operating time, blood loss, and need of additional surgical window were documented.

Postoperatively, reduction quality of the fractures was assessed by using the above-mentioned standard plain radiographs. Reduction of the pelvic ring fractures and acetabular fractures was evaluated separately using the criteria put forward by Matta¹⁴ and Matta and Tornetta¹⁵ (Table 1).

All patients were followed up at 6 weeks, 3 months, 6 months, and 12 months after initial surgery. The same set of standard radiographs were taken at each time point for detection of (1) loss of reduction; (2) unusual progress of fracture union; (3) implant failure; (4) heterotopic ossification; and (5) osteoarthritic change using gradings again defined by Matta.¹⁴ Clinical and functional outcomes were charted for all patients by one single author at 12 months postoperatively (Table 2). They included the patients' mobility status, pain (using visual analogue scale of 0–10), integrity of obturator nerve in terms of hip adduction power, and light touch sensation over the medial thigh. Two functional scores were also measured, namely the Harris Hip Score¹⁶ and the Merle D'Aubigne

Table 1

Criteria in assessing quality of reduction of pelvic ring/acetabulum fractures according to Matta¹⁴ and Matta and Tornetta¹⁵

Quality of reduction for acetabular fractures:	
Anatomical:	0–1 mm step
Imperfect:	2–3 mm step
Poor:	> 3 mm step
Surgical secondary incongruence: acetabulum is reduced but displacement of the innominate bone alters the joint position	
Quality of reduction for pelvic ring fractures:	
Excellent:	≤ 4 mm step
Good:	4–10 mm step
Fair:	10–20 mm step
Poor:	> 20 mm step

score (MDA) modified by Matta and Tornetta.¹⁵ The MAS, a score widely used for evaluating patients with pelvic–acetabular fractures, consists of three main items: degree of pain, ambulation, and range of motion. MAS constitutes a maximum score of 18. The MAS can then be further interpreted as excellent for 17 points or 18 points, good for 15 points or 16 points, fair for 13 points or 14 points, and poor for < 13 points.

Complications were recorded with special attention to occurrence of infection, neurovascular injury, fracture nonunion, and breakage of implant.

Statistical analysis was completed using SPSS for Windows version 21.0.0 (SPSS Inc., Chicago, IL, USA). Pearson's χ^2 test was used to delineate differences between categorical variables. The independent samples *t* test and one-way analysis of variance test were employed for comparison of means among two or more groups, aiming to detect outcome differences among patients of different age groups and fracture characteristics. Spearman's correlation coefficient was used to look for correlation between quantitative variables. A *p* value ≤ 0.05 was considered to be statistically significant.

Operative details

All operations were performed with the patient lying supine on a flat radiolucent table, permitting fluoroscopic guidance of reduction and fixation. The entire abdomen and ipsilateral lower limb were draped mobile, with the hip and knee flexed with bumps to relax the iliopsoas muscle and external iliac vessels (Figure 1). Prophylaxis against deep vein thrombosis was provided intraoperatively by intermittent pneumatic compression stockings. A Foley catheter was inserted for decompression of the urinary bladder. Shaving of the pubis and administration of prophylactic antibiotics were done upon induction of anaesthesia.

As all our patients had received retroperitoneal packing with low-midline approach as initial emergency management, we utilised the same incision for our modified Stoppa approach. The incision was from a point just distal to the umbilicus down to the level of pubic symphysis. The anterior rectus sheath was opened vertically in midline by incising the linea alba (Figure 2). The pubic symphysis was then reached by blunt dissection at the preperitoneal space. Lateral exposure was gained by upward reflection of the peritoneal sac away from the fracture side, with care

Table 2

Clinical and functional outcomes measured

1	Ambulatory status
3	Pain (using Visual Analogue Scale of 0–10)
4	Hip adduction power and medial thigh light touch sensation (obturator nerve integrity)
5	Harris Hip Score
6	Modified Merle d'Aubigne Score

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