

ORIGINAL ARTICLE

Surgically Treated Type C Injuries of The Pelvic Ring: A Study Of 21 Patients

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ABSTRACT

Internal fixation has been found to be the preferred agent in Type C pelvic ring damages, however controversy over the surgical technique and technique continues. We studied 21 consecutive patients with pelvic ring damages of type C1-C3 who were treated with standardized reduction and internal fixation techniques. Our results suggest a correlation between excellent reduction accompanied by adequate pelvic ring fixation and a favorable outcome. Unsatisfactory reduction (dislocation > 5 mm), fixation failure, lack of reduction and permanent damage to the lumbosacral plexus were the most common reasons for an unsatisfactory result. Our results suggest that special attention should be paid to preoperative planning, fracture reduction, nerve root decompression, and fixation of maximally extreme sacral fractures. Our results appear to favor internal fixation of displaced (>10 mm) and evanescent rami fractures and symphysis disorders together with posterior fixation to achieve greater balance of the entire pelvic ring.

KEYWORDS: Pelvic ring, Type C Injury

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INTRODUCTION

Unstable pelvic ring disease results from overcurrent trauma and is regularly associated with a range of collateral damage [1, 2]. Hemorrhage, head trauma, minor pelvic injuries, and headache number one are responsible for exaggerated mortality rates [3]. If the affected person is hemodynamically unstable, the first dream is to manipulate the airway to establish adequate airflow and maintain blood flow. The external fixator can also play a role in partially stabilizing the pelvic ring, reducing pelvic volume, increasing tamponade and thereby reducing bleeding [4]. Once those affected have stabilized, a careful assessment and definitive repair of the pelvic ring damage can be made. In the 1970s, external fixators became known as the definitive cure for transient pelvic ring injuries [5]. It was later found that an anteriorly placed outer body could not adequately compensate for transient (Type C) pelvic ring dysfunction to allow the victim to mobilize without risking fracture redislocation [6]. More recently, closed reduction and percutaneous screw fixation strategies have been developed [7]. Internal fixation has become the desired remedy for transient posterior pelvic ring damage [8], but indicators of fixation for anterior pelvic ring damage have varied [9]. Biomechanical studies have shown that fine compensation for type C pelvic ring fractures can be achieved by internal fixation of the posterior and anterior pelvic ring damage [10]. In recent years, our mission has been to repair the anatomy of the pelvic ring using standardized reduction and internal fixation strategies for the posterior and anterior elements of the pelvic ring. Our speculation changed to the fact that in addition to posterior fixation, displaced (>10mm) and transient anterior defects with fractures of the pubic bone or a symphysis dysfunction, or

both, need to be treated with internal fixation. For the prevailing potential study, we evaluated the long-term radiological and medical effects of this approach.

MATERIAL AND METHODS

All displaced and risky damage of the posterior pelvic ring with sacral fracture, dislocation or dislocation fracture of the sacroiliac joint, or pelvic bone fracture have occurred as warning signs for open or closed reduction and internal fixation. Displaced (> 10 mm) fractures of the pubic bone or overall symphysis disease or both were additionally treated with internal fixation. An associated displaced acetabular fracture was added to an open reduction and internal fixation image (14 fractures in 12 patients).

We studied 21 consecutive patients with type C pelvic ring injuries treated with open or closed reduction and internal fixation strategies between May 2020 and October 2021 within three weeks of injury. The implied age of the data subject at the time of the harm is 35 (18-76) years. 8/21 sufferers had associated lumbosacral plexus damage. Two patients with type C damage also had a concomitant thoracolumbar vertebral fracture with partial spinal wire or cauda equinae damage and paraparesis. 7 people had bladder rupture and all of these patients were treated surgically. No urethral rupture was observed in this series.

Postoperative treatment

In the case of type C1 injuries, mobilization with crutches was started within 1-2 days without loading the injured side and if the corresponding injuries to the lower extremities permitted. Full training was started after 8-12 weeks. The loading was increased incrementally, mainly based on the type of fracture and the radiological follow-up. With type C3 damage and maximum type C2 damage, running games on crutches were started after 8-12 weeks, depending on the form of the posterior pelvic ring damage.

Radiological assessment

Vertical displacement within the posterior and anterior pelvic ring damage was measured using AP pelvic radiographs. Vertical displacement was measured as the difference between the apex of the femoral head (C1-1 and C1-2 damages) and the advanced factor of the sacrum (C1-three damages) originated from a line perpendicular to the long axis of the sacrum from the AP -X-rays [11]. The AP displacement of the posterior pelvic ring damage was decided by CT. The radiographs were taken before the first treatment, after reduction and internal fixation, and at the very last follow-up visit. The AP displacement of the anterior pelvic fragments could not be reliably measured by CT. Radiographic results were graded based on the maximum residual displacement within the posterior or anterior pelvic ring damage as follows: excellent, 0-5 mm; good, 6-10 mm; light, 11-15 mm; and poor, more than 15 mm [12]. The analysis was carried out by all authors.

Outcome evaluation

The recommended follow-up time was 23 (12-85) months. All 21 patients were medically evaluated, with detailed interest in their gait, hip movements, and difficulty sitting, pelvic tilting or tilting, scoliosis, and chronic motor and sensory nerve defects. The neurological examination was carried out from L4 distally before and after the operation with the help of the treating surgeon and in the very last follow-up with the help of the first author. Motor neurological deficits in the wasting extremities were rated on a 6-point scale: 0, no palpable muscle action; 1, muscle contraction palpable, does not produce limb movement; 2, limb actions, however, much less than full range of motion contrary to gravity; 3, actions limb section by complete variety of movement against gravity; four, muscle energy higher than true but much lower than usual; and five, usually similar to the contralateral common limb [13].

Residual pain was rated as: no pain, mild (intermittent, normal activity), moderate (limits activity, relieved by rest), and severe (continuous rest, difficult during activity). Pelvic ring pain (anterior or posterior) online site recorded. The authentic scoring machine was brought to consciousness in the final results after a fleeting break in the pelvic ring and now out of handicap due to some injuries. Also, the most recent assessment for final medical outcomes was changed to primarily reflect final outcomes after pelvic injury [14].

The Hanoverian pool result rating was mainly used for the assessment [15]. This device evaluates the rankings of the radiological final score and the medical final score as a rating on a 7-factor scale, with most of seven factors representing an excellent final result, 6 factors representing an excellent final result, four and five factors representing a true final result and a pair and three factors indicate a terrible or poor end result. This device also takes into account urological defects. The final evaluation of the results was carried out with the help of the first author. We examined urological and sexual deficiencies through interviews. The urological findings were categorized into increased frequency of urination, pain in urination, disturbance of bladder characteristics and incontinence. Men were examined for erectile

dysfunction and girls for dyspareunia [15]. The evaluation of the feature of urinary tract reduction with urodynamic examinations was no longer achieved in patients without clear urological symptoms.

Statistics

All statistical evaluations were performed using SPSS 11.0.1 for Windows (SPSS Inc., Chicago, IL, USA). The more than one logistic regression analysis with the Ahead-Step-Sensible technique was used to find undistorted elements that are likely to be correlated with the result. Both raw and changed odds ratios with 95% confidence periods are reported and values other than 1 are considered statistically significant.

RESULTS

Posterior and anterior fixations were completed in 12 of 21 patients. 10 anterior fixations were internal and a pair was external. Posterior fixation was easiest in nine patients; four of these patients (type C3 damage) had no anterior damage and five had minimally displaced (<10 mm) anterior damage. 6 had bilateral posterior Type C defects and internal fixation was changed to complete in all respects in 5 of these patients and anterior defects were constant for plates (Figure 1). 58 sacral iliac screws were inserted in 12 patients, 8 of them (7 patients) percutaneously without open reduction of the fracture. The implicit operative time for posterior fixation was changed to 98 (15-325) min and 95 (20-225) min for anterior fixation. The longest operative time protected the fixation of the accompanying acetabular fracture. The implicit total blood loss changed to 1.4 (zero, 1 - 5, 0) L. 7 of the patients underwent surgery within 24 hours of the injury.

Final X-ray results were extremely good in 7 patients, accurate in 5 patients and true in 9 patients (no final negative result). The preliminary preoperative displacement (vertical or AP displacement) changed to more than 10 (10-60) mm within the posterior or anterior ring damage or at any pelvic ring damage. Three patients with an unsatisfactory (correct or negative) final radiograph result all had fixation failure number one. The fixation fails in the posterior pelvic ring, at the same time it fails in 1 patient in the anterior pelvic ring.

The results of the practical evaluation were extremely good for nine subjects, negative for 7, exact for 6 and negative for zero subjects. They were definitely tormented by a severe anatomical reduction. Unsatisfactory (true) clinical outcomes were associated with lumbosacral plexus damage in 6/12 patients. In this subgroup, three people had an unsatisfactory reduction result. In 1 of 12 patients, the unsatisfactory practical end result was accompanied by a non-anatomical reduction, in 1 spinal canal stenosis there is no longer any connection with the pelvic fracture. In 2 patients, the practical results were unsatisfactory due to overdue pain in the posterior part of the pelvic ring, despite an exceptional radiological end result. 13/21 sufferers had overdue pain problems, and in eight of them the pain specifically changed to an area within the posterior pelvic ring.

All patients with concomitant lumbosacral plexus damage confirmed at least some evidence of neurological healing. At the very last follow-up, 14 patients had complete neurological healing and no motor or sensory defects in the lower legs. All but 1 of these patients had extremely good or precise practical results. The affected person with a negative outcome had pain in the back of the pelvic ring. Eight patients had the mildest sensory impairment at follow-up and their practical results were extremely good or accurate. Partial motor deficits were noted in 18 patients, and six of these patients had persistent radicular pain in the lower leg at the most recent follow-up.

Most patients with an extremely good or accurate final radiological result (16/18) had at least an amazing practical final result. A high degree of agreement between the radiological and practical results changed (odds ratio four, zero; 95% CI: 116). 7 patients with an extremely good or amazing radiographic final result had a true or negative practical final result. The biggest key aspect related to this location changed into the prevalence of symptomatic lumbosacral plexus or nerve root damage (motor deficiencies) found in four of these 7 patients but most easily in three of the 19 patients who had an extremely good or amazing final radiological and practical result (OR 9.2; 95% CI: 2.735.3).

In the analysis of unmarried prognostic elements and additionally within the multifactorial analysis, a clear correlation between a very good radiological end result (displacement of now no more than 5 mm) and practical end results was shown. Permanent neurological damage also confirmed that it was among the very last practical end results within the statistical analysis. In contrast, the fracture type (C1, C2 or C3) and the injury severity score no longer showed any connection with practical healing. Female intercourse and age (< 33 years) are other valuable prognostic elements.

Urologic defects were found in 3 men and 2 women. 1 of these patients had increased frequency of urination and four had bladder dysfunction. five male victims suffered from erectile dysfunction. Urologic and sexual deficiencies were associated with excessive lumbosacral plexus damage in 6 of the 9 patients. In 1 affected person, this may have changed due to a bladder rupture. In 2 patients, the purpose of erectile

dysfunction became uncertain as they had no associated neurological or urological damage. The Hanoverian pelvic final result assessment, which mixes the radiological and scientific results up to an unmarried assessment, changed in 15 patients to very good, in 3 patients to accurate, in 2 patients to and in 1 patient to negative. Complications were rare, but some of them were excessive. After internal fixation, there was no reduction in 2 patients. In four patients this occurred within the posterior pelvic ring and two of these patients underwent reoperation.

DISCUSSION

The balance of the pelvic ring is particularly dependent on the integrity of the posterior supporting sacroiliac complex. However, biomechanical studies have shown that in type C damage, the pubic symphysis and pubic ramus are critical to the overall balance of the pelvic ring, accounting for approximately 40% of the total ring balance [16]. Biomechanical studies have also shown that in transient type C injuries, an anterior external fixator cannot restore sufficient balance to allow stable mobilization of the victim without the risk of fracture redislocation [17, 18]. Our speculation has changed that by using internal fixation in the posterior and anterior pelvic rings you can get damage with a clean instability and avoid headaches.

Reading the consequences of pelvic ring damage can regularly lead to interpretation problems, since neurological and various accompanying damage can also influence a meaningful recovery. In particular, the useful scoring machine defined by Majeed (1989) has been modified to account for final outcomes after pelvic injuries [19]. An excellent scoring device makes it easy to distinguish between exceptional medical collections and fracture types. In our study, the final follow-up outcome reviews were performed with the same author to avoid inter-observer variability. On the other hand, the useful reviews were no longer blinded and the use of an impartial reviewer could have been a better way of conducting the reviews. In the medical application, sequential reporting of radiological and positive outcomes provides more specific statistics about final outcomes than unmarried assessment, which confuses all important parameters. In the future, verified analysis of end-of-pool results could be useful to assess the consequences of different medical collection and remedy protocols.

Internal fixation has emerged as the preferred approach for transient damage to the posterior pelvic ring, but the suitability of very large residual displacement remains controversial. Baron MD et al. 2021 reported that 10mm was found to be an appropriate T-bar for posterior pelvic ring damage and that an additional anatomical T-bar for posterior damage no longer causes much less posterior pain [20]. Some investigators said that residual posterior pelvic ring displacement greater than 10 mm resulted in a negative prognostic sign [21]. In the Hannover score, final results were considered accurate if the remaining posterior displacement was greater than five mm. However, our look at a fantastic X-ray result (maximum residual displacement of 5mm within the posterior or anterior pelvic ring damage) confirmed a clean connection with fantastic or semi-decent final results.

Sacroiliac screw fixation is typically recommended for fixation of sacral fractures, sacral iliac luxations, and sacral iliac fractures [22]. However, care should be taken when inserting cannulated screws into the sacrum medial to the sacral foramina. All of our patients suffered damage to the L5 nerve root in one case. The most risky and comminuted sacrum fractures are scientific problems since it is unlikely to be possible to achieve proper balance of the pelvic ring with sacral ilioscrews alone. These 6 patients with secondary displacement after screw fixation were examples of this. The most extreme posterior pelvic injuries require a unique interest and careful preoperative planning. Five of our patients with sacral fractures were no longer in fixation as the anterior displacement became minimal. The posterior damage sample was incorrectly scored as more severe, leading to worsening of localization in 2 patients, although anterior pelvic ring damage with plates remained constant. This also aids in the use of internal fixation for minimally displaced sacral fractures with excessive force. Minimally displaced lateral sacral fractures appear amenable to percutaneous fixation strategies with cannulated screws located below fluoroscopic guidance.

The usual practical results were fair or excellent in 83% of our patients and were definitely plagued by severe anatomical or near anatomical reductions. Unsatisfactory reduction, failure of fixation and lack of reduction (maximum residual displacement > 5 mm) confirmed a statistically widespread association with the unsatisfactory practical end result. A reduction malfunction or lack of reduction is expected to be corrected later than 6 weeks after trauma in the case of reoperation. In all of our five reoperations, a clean radiological correction is completed with a fine practical implementation of four of them. In addition, there was an association with permanent neurological damage and unsatisfactory practical outcomes while analyzing unmarried prognostic items. In four of our sufferers, the cause of an unsatisfactory practical outcome became uncertain as all of these sufferers had a great postoperative outcome and no

longer had any neurological damage. Lumbar plexus damage was the leading cause of unsatisfactory practical causes for patients with concomitant urological damage.

Early reduction of the posterior pelvic ring appears to reduce neurological damage. It can be assumed that the healing of the lumbosacral nerves depends on the level of previous damage to the nerve roots and also on mechanical elements such as tension or compression of the neurological system by bone fragments [23, 24]. Reduction of the half of the pelvis, prevention of traction of the injured nervous system by stabilization of the tire and decompression of the sacral nerve roots appear to be important for neurological healing. This must be carried out urgently within the first phase (within 1 or 2 days) if there is a suspicion of nerve damage and hemodynamic stabilization of the person concerned.

Our results suggest that there may be advertising between the radiological and useful end results. But even if the reduction of the pelvic ring fracture is anatomical, ongoing neurological damage can confuse useful end results. Unsatisfactory reduction, fixation failure, lack of reduction and permanent damage to the lumbosacral plexus were the highest, not uncommon, motives for an unsatisfactory user result. Unstable pelvic ring damage with revolutionary distraction or compression of the nerve roots with neurological deficits are red flags for surgical repair within phase number one, once the sufferer has stabilized hemodynamically. Particular attention should be paid to the preoperative preparation of plans and the fixation of the most extreme sacral fractures. Today's results address the desire for reduction and internal fixation in symphysis disease and displaced (>10mm) and risky pubic fractures along the occlusal posterior fixation to achieve greater balance for the entire pelvic girdle.

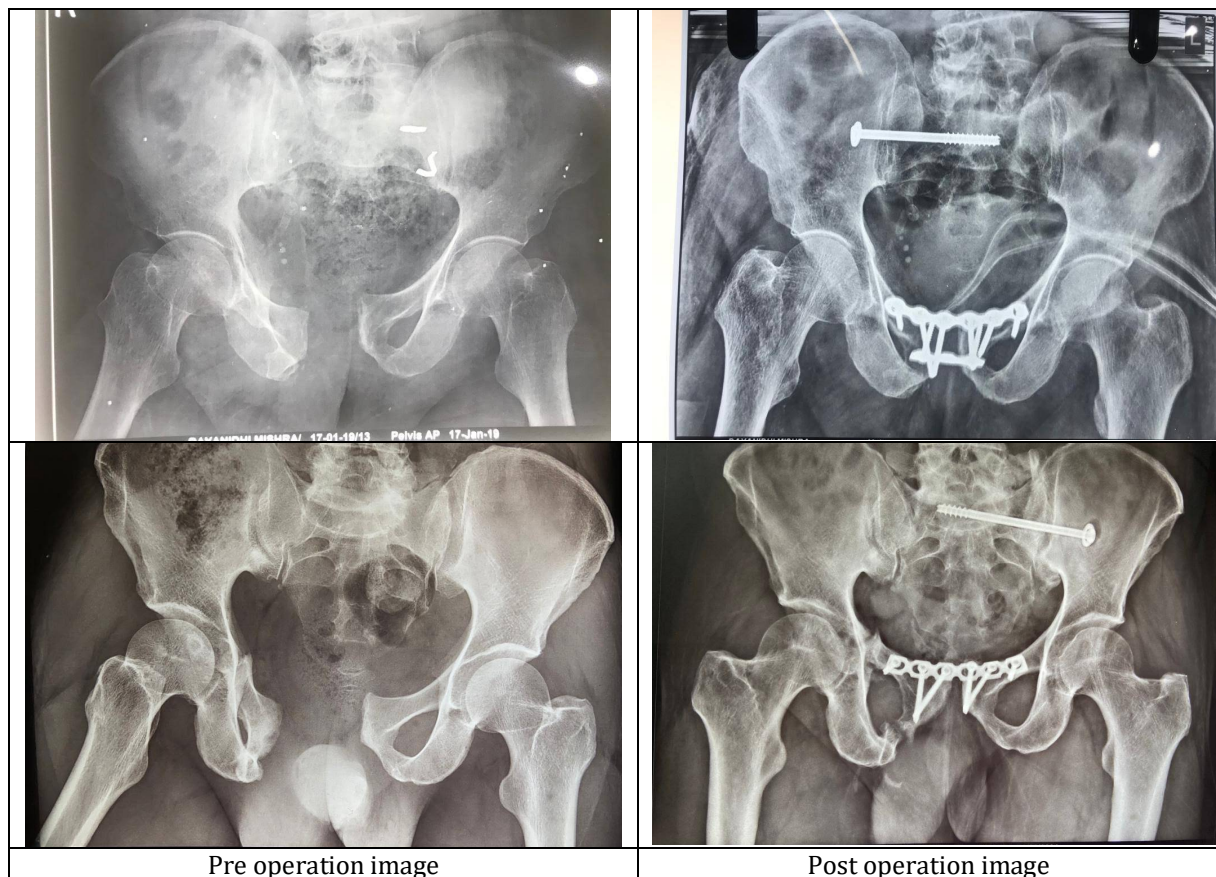


Figure-1, The patient's lower midline incision is fixed with a long 3.5 mm reconstruction plate

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