



Isolated iliac wing fractures : are they really that benign?

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The aim of this study was to review the incidence, management and outcome of isolated iliac wing fractures and to compare them with other type A, B and C fractures.

From 2004 to 2015, the data of 547 patient with a pelvic fracture regarding age, gender, RTS, ISS, treatment, complications and mortality were analyzed and a comparison was made between iliac wing fractures and the other pelvic fractures.

We encountered 30 isolated iliac wing fractures. The ISS, shock class, transfusion rate, complications and mortality were comparable to those of patients with an unstable pelvic fracture. Concomitant injuries were observed in 93% of the patients. None of the fractures were operatively stabilized.

Isolated iliac wing fractures are rare, and operative stabilization of the fracture itself is often not necessary. However, these fractures are serious injuries with characteristics resembling those of patients with an unstable pelvic ring injury

Keywords : iliac wing ; pelvic fracture ; treatment ; outcome

according to the AO/OTA (11), which means that the integrity of the pelvic ring remains intact. The risk for major bleeding from the venous plexus, which is often seen in unstable pelvic fractures, is considered low. However, arterial injury is sometimes seen (14).

Because of the rare incidence of this type of fracture, little evidence is available in the current literature regarding the management of these fractures. Some authors promote open reduction and internal fixation (14). However, the general opinion is that these fractures do not require operative stabilization, and patients can be managed non-operatively (1). Due to the force of the impact that is required to fracture the iliac wing (6), a high risk of concomitant injuries exists. Reported associated injuries have included large skin injuries, organ ruptures (1), neurological lesions (2), and significant damage to the abdominal wall.

The aim of this study was to review the incidence of these fractures in our hospital, evaluate the treatment, complications and outcome in this patient group and compare these fractures with other pelvic ring injuries.

INTRODUCTION

Isolated fractures of the iliac wing after a direct impact are uncommon, and little information can be found in the literature regarding this injury. The incidence of this type of fracture is reported to be around 2% of all pelvic fractures (1,14). The fracture is classified as a Tile A injury (15) or as 61-A2

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PATIENTS AND METHODS

The charts of 547 consecutive patients with pelvic fractures and were admitted to the Radboud University Nijmegen Medical Center (RUNMC) during the period of 2004 to 2015 were reviewed. The RUNMC is a trauma center and a supra-regional referral center for pelvic and acetabular fractures. Also, it is the primary hospital for the Dutch Helicopter Emergency Medical Service (HEMS) for the central, south and east part of the Netherlands. Patients with an isolated iliac fracture without involvement of the pelvic ring or acetabulum were selected. Patients younger than 16 years were excluded. The diagnosis of an isolated iliac wing fracture was confirmed on a plain pelvic X-ray as well as on a CT scan. No patients who were referred to our clinic with late/secondary problems (such as a pseudoarthrosis) were included in this analysis.

The following data were reviewed : gender, age, mechanism of injury, Revised Trauma Score (RTS) (10), Injury Severity Score (ISS) (3), shock class, concomitant injuries, open fracture classification according to Gustilo and Anderson (7), treatment, complications and mortality.

A comparison was made among the isolated iliac wing fractures, other Tile A fractures and unstable fractures (Tile B/C).

RESULTS

Among 547 patients, we evaluated 147 Tile type A fractures (26%), 211 type B fractures (39%) and 189 type C fractures (35%).

Of the Tile A fractures, 0 were of the type A1 (0%) ; 112 were type A2 (63%) ; and 25 were type

A3 (17%). Of the Tile B fractures, 49 patients had a B1 fracture (23%) ; 129 had a B2 fracture (61%) ; and 33 had a B3 fracture (16%). Of the Tile C fractures, 118 patients had a C1 fracture (62%) ; 31 had a C2 fracture (16%) ; and 40 had a C3 fracture (22%).

Of the 122 patients with a Tile A2 fracture, 30 had an isolated iliac wing fracture (22%).

Of these 30 patients with an isolated iliac wing fracture, 25 (83%) were male. All but 2 patients had high-energy trauma and were treated according to ATLS® guidelines. The other 2 patients were involved in a fall from stairs. Seventeen patients were involved in a motor vehicle accident, 9 patients fell from a height (range 5-12 meters) and 2 patients sustained a crush injury. The mean age was 45 years (range 16-80 years), the mean RTS was 10.5 (range 6-12), and the mean ISS was 25 (range 4-75). At presentation to the ER, 4/30 patients had an unstable pelvis during the physical examination and were given a T-POD.

Minor displacement of the iliac wing fracture was observed in 9 patients. In 21 patients, major displacement (>2 cm) or severe comminution were present.

Table 1 shows a comparison of patient characteristics between the different fracture types. Patients with an isolated iliac wing fracture had a high ISS (mean 25), percentage of hemodynamic instability (53%) and percentage of open pelvic fractures (20%). These findings were comparable to the profile of patients with unstable pelvic ring fractures.

Of the patients with an open fracture in this group, 5 had grade 2 injuries according to Gustilo and Anderson, and 1 patient had a grade 3 open injury.

Table 1. — Patient characteristics : all values are presented as the mean (range), except for Males, HET and Open fractures. HET=high-energy trauma

	Isolated iliac wing (n=30)	Tile A other (n=117)	Tile B (n=211)	Tile C (n=189)
Age (years)	45 (16-80)	56 (19-100)	42 (18-88)	40 (17-87)
Males	28 (93%)	49 (42%)	140 (66%)	120 (63%)
HET	28 (93%)	47 (40%)	195 (92%)	184 (97%)
RTS	10.5 (6-12)	11 (7-12)	11 (5-12)	10 (4-12)
ISS	25 (4-75)	18 (4-66)	26 (9-75)	33 (16-75)
Shock class \geq 2	16 (53%)	40 (34%)	72 (34%)	128 (68%)
Transfusion with PRBCs	10 (33%)	27 (23%)	56 (27%)	112 (59%)
Open fracture	6 (20%)	0	4 (2%)	13 (7%)

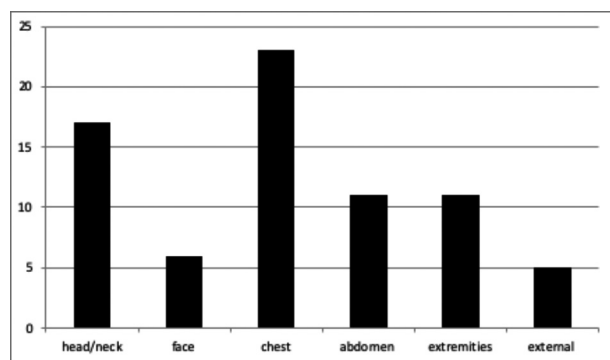


Fig. 1. — Concomitant injuries



Fig. 2. — Comminuted isolated iliac wing fracture

Of these 6 patients, 2 had an evisceration of the small bowel through the fracture site. All patients were treated with antibiotics, debridement in the OR and, if necessary, closure of the abdominal wall (either primarily or with a vacuum-assisted closure

device). In one additional patient, a Morel Lavallee injury was observed on the contralateral side. Operative drainage of the seroma was performed on day 5, with good recovery of the patient. No operative fixation of the fracture was performed in these patients.

Concomitant injuries were observed in 28 patients (93%), and concomitant injuries of patients with an isolated iliac wing fracture are listed in Fig. 1. The percentages of concomitant injuries were 83% and 90% in the groups with Tile B and C fractures, respectively. The percentage was 76% among patients with other type A fractures.

Before admission, 3 patients were treated with a pelvic binder due to the suspicion of an unstable pelvic fracture. The binders were removed after the diagnosis was made. No patients underwent surgical treatment of an iliac wing fracture. In the 6 patients with open fractures, the wounds were debrided, and sequestrers were removed if necessary. A laparotomy was performed in 8/30 patients. No patients in the group with Tile A2 and A3 fractures were surgically treated for the fracture. The stabilization percentages in the groups with Tile B and C fractures were 36% and 83%, respectively.

The complications for all groups are listed in Table 2. Thirteen patients with an iliac wing fracture did not develop complications during admission. Complications related to bowel injury were observed in 4 patients with an iliac wing fracture. Two patients developed ileus, of which, one case was due to herniation through the fracture fragments. These patients had to be operated upon to release the obstructed bowel from the hernia. The hernias were repaired with a

Table 2. — Complications

Major Complications	Isolated iliac wing (n=30)	Tile A other (n=117)	Tile B (n=211)	Tile C (n=189)
Sepsis	4 (13%)	4 (3%)	8 (4%)	15 (8%)
SIRS	0	1 (1%)	11 (5%)	11 (6%)
Pneumonia	4 (13%)	4 (3%)	23 (11%)	29 (15%)
Recurrent bleeding	0	0	3 (1%)	4 (2%)
Failure of osteosynthesis	0	0	1 (1%)	6 (3%)
Minor complications				
Urinary tract infections	0	7 (6%)	6 (3%)	15 (8%)
Superficial wound infection	3 (10%)	7 (6%)	17 (8%)	14 (7%)
Delirium	4 (13%)	5 (4%)	27 (13%)	9 (5%)
Other	7 (23%)	5 (4%)	32 (15%)	27 (14%)



Fig. 3. — Iliac wing fracture with severe displacement and disruption of the abdominal wall

mesh, and some fracture fragments were excised. The patients recovered uneventfully. Two patients were admitted with small bowel injuries and had multiple intra-abdominal abscesses and several re-operations. In one of the patients with small bowel injury, enterocutaneous fistulae developed, and the patient was treated with prolonged IV nutrition and resection of the fistulae after 3 months. In both patients, fracture fragments were the cause of the bowel perforation. Fig. 3 shows a CT image of a patient with severe displacement of the iliac wing fracture and disruption of the abdominal wall.

In the group with Tile B and C fractures, 11 patients sustained injuries to the bowel and were managed operatively. However, the fracture fragments did not penetrate the bowel in any of these patients.

The mean length of stay (LOS) was 16 days. Twenty of 30 patients were admitted to the ICU. The mean LOS in the ICU was 7 days. Four patients

died (13%). Three patients died due to (sequelae of) hemorrhagic shock after 3-50 days. A combination of intra-abdominal bleeding caused by splenic, liver and kidney ruptures and the bleeding related to pelvic fracture contributed to this shock. One patient died because of respiratory failure. This patient had a history of COPD Gold 4.

Comparisons of the LOS, ICU LOS and mortality between the different fracture types are listed in Table 3. In the group with isolated iliac wing fractures, patients with open fractures were admitted to the hospital for significantly longer than patients with closed fractures were (44 vs. 7 days, $P < 0.01$), mainly due to intra-abdominal abscesses and enterocutaneous fistulae. In the patients with Tile B or C fractures, the LOS did not differ significantly between the open and closed fractures.

Complications during the follow-up of isolated iliac wing fractures were observed in 3 patients (10%). One patient developed pseudoarthrosis of a closed comminuted fracture, with significant displacement of the fragments. However, he had only mild complaints and did not wish to undergo surgery. In 2 patients, a hernia developed above the iliac crest. In both patients, the hernia was repaired at a later stage. The mean follow-up was 29 months (range, 1.5-84 months).

DISCUSSION

Comminuted fractures of the iliac wing without instability of the pelvic ring are often regarded as less severe injuries than rotatory or vertically unstable pelvic fractures. Nevertheless, the iliac bone is as resistant to heavy forces as are the other pelvic bones (6); consequently, a high-energy impact is necessary to cause the fracture. In our study, most patients had multiple injuries. Our cohort had a mean ISS of 25, and most patients had severe concomitant injuries. A comparison of these patients with patients with an unstable pelvic ring injury showed that all patients

Table 3. — Length of stay in days (range) and mortality

	Isolated iliac wing	Tile A other	Tile B	Tile C
LOS	16 (1-120)	13 (1-142)	19 (1-72)	25 (1-160)
ICU LOS	7 (0-37)	4 (0-39)	5 (0-64)	7 (0-59)
Mortality	4 (13%)	16 (13%)	20 (9%)	30 (16%)

had a similar profile with respect to ISS, shock class and transfusion rates.

The iliac wing fractures were not operatively stabilized in any of our patients.

Switzer et al. (14) reported 13 patients with an iliac wing fracture, of which, 8 had concomitant fractures that compromised the stability of the pelvic ring. Five patients with an isolated fracture of the iliac wing were also treated operatively with open reduction and internal fixation (ORIF). Fracture healing was successful in all patients. In our patient group, only 1 patient had pseudoarthrosis of the fracture, with only mild complaints. A study by Abrassart et al. (1) also showed successful healing of non-fixated comminuted iliac wing fractures in 8 patients, and 2 patients were operated upon due to severe displacement of the fragments and obstruction of the bowel. They concluded that standard operative fixation for these fractures should not be advocated. However, follow-up of these patients remains necessary because the incidence of symptomatic pseudoarthrosis or abdominal hernia might be underestimated in this series. Patients referred to our clinic with painful pseudoarthrosis of an iliac wing fracture are encountered incidentally, and operative treatment is usually necessary in this group.

In our group of patients with iliac wing fractures, a high incidence of open pelvic fracture was observed (20%). In most studies regarding open pelvic fractures (4,5,8), there seems to be a predominance of type B and C injuries and a high mortality rates. In our study, none of the patients with an open fracture died. This can be explained by the fact that no significant bleeding occurs due to the fracture. However, the morbidity is high, especially in patients with bowel perforations. In our group, 2 patients had a bowel perforation resulting from dislocated fracture fragments that had penetrated the small bowel. These patients required multiple surgeries to manage intra-abdominal abscesses, wound dehiscence and enterocutaneous fistulae. Open fractures, especially grade 2 and 3 fractures, should be treated aggressively with extensive irrigation of the wound and debridement, as well as the use of antibiotics (5). For grade 1 open fractures, a less aggressive approach is warranted, involving

wound excision and primary closure with antibiotic treatment.

Anatomically, the transverse abdominal, external and internal oblique muscles are attached to the iliac crest. Therefore, should severe fracture displacement occur, herniation of the abdominal contents through the disrupted abdominal wall can result. This is a known entity after bone grafting from the iliac crest (12,13). In our study, 2 patients underwent surgery due to a bowel obstruction at the fracture site. During the follow-up, 1 patient developed a symptomatic hernia above the iliac crest, and this patient was treated with a component separation technique to restore the abdominal wall.

The mortality was quite high in this patient group (13%) and was comparable to the mortality among patients with type C fractures. The lower mortality in the type B group was explained by the presence of a high percentage of intrinsic, stable type B2 fractures with a relatively low ISS in our cohort. This finding can also explain the low percentage of fixation in type B fractures.

The mean follow-up was 29 months. However, a limitation of this study is the lack of standardized long-term follow-up and no measurement of functional outcome scores. An evaluation of functional outcome with the SF-36 and the Majeed questionnaire (9) is currently being conducted in a prospective trial.

CONCLUSION

Isolated iliac wing fractures without instability of the pelvic ring are rare. Although the stability of the pelvic ring is intact, and fracture stabilization is not mandatory, most patients have severe concomitant injuries. The ISS, shock class, complications and mortality are high and are not significantly lower than in patients with an unstable pelvic ring injury. Furthermore, complications during follow-up are not uncommon. Therefore, patients with an isolated iliac wing fracture after a high energy trauma warrant a high level of caution and should be regarded as having a potentially serious injury.

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