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Weight-Bearing Restrictions after Acetabular Fracture, Necessity or False Hope? A Brief Observational Study

Omezení zatěžování končetiny po zlomenině acetabula: nezbytnost, nebo falešná naděje? Stručná pozorovací studie

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ABSTRACT

PURPOSE OF THE STUDY

Most common postoperative treatment recommendations after acetabulum fractures suggest at least 6 weeks of postoperative partial or non weight-bearing. To protect the osteosynthetic construct this surgically set weight-bearing limit is trained by physical therapy. Aim of our analysis was to determine the free field patient compliance to these weight-bearing restrictions and observe their influence on the early postoperative radiographic imaging.

MATERIAL AND METHODS

Patients after surgical treatment of an acetabulum fracture were included in our analysis. Every patient was instructed to maintain a 20 kg weight-bearing limit for 6 weeks. Postoperative weight-bearing was continuously monitored during this time with a pressure measuring insole. Maximum weight-bearing per day was recorded and maintenance of reduction assessed after this time.

RESULTS

In total 10 patients were included into the study. Only 1 patient stayed within the weight-bearing limit during the analysis. Maximum weight-bearing as high as 110 kg was recorded. All patients maintained postoperative reduction at the 6 week timepoint.

DISCUSSION AND CONCLUSIONS

Despite regular physical therapy training compliance to the generally accepted weight-bearing limits was low. Regardless of the non-compliance the radiographic outcome remained unchanged. Further analysis on the use of permissive weight-bearing aftercare regimes are warranted.

Key words: weight-bearing, acetabulum fracture, compliance.

INTRODUCTION

Fractures of the acetabulum are severe injuries that are associated with decreased outcome whenever adequacy of reduction cannot be maintained, or when subluxation occurs (9, 10). To protect the postoperatively achieved reduction most protocols, as well as postoperative management recommendations such as through the AO Surgery Reference website suggest a period of non, or restricted weight-bearing (1, 8). However, non weight-bearing has been shown to be associated with higher contact pressures at the hip joint than partial weight-bearing, as well as higher energy expenditure (4, 7). Furthermore studies have shown, that gait and weight-bearing, regardless of restrictions lead to less hip joint contact pressures that other movements, such as getting up from a chair (11). Different studies in select acetabulum fracture cases have thus already suggested that permissive full weight-bearing regimes after these injuries can be safe (6). Furthermore studies looking at free field compliance rates after other periarticular fractures have already shown this to be low and without associated consequences (2).

Aim of our study was thus to continuously investigate the early postoperative weight-bearing behavior of patients with surgically treated acetabular fractures and determine the association of compliance and early radiographic changes.

MATERIAL AND METHODS

The study was designed as a brief, prospective, observational study. Consenting patients with surgically treated acetabular fractures were included and treated with our standard aftercare protocol consisting of a 6 week 20 kg weight-bearing restriction. Daily physical therapy and weight-bearing training was performed during the inpatient treatment phase and a minimum of

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Table 1. Patient age, treatment- and weight-bearing characteristics are shown

Patient age	Fracture	Treatment	Maximum weight-bearing (kg)	Average daily activity (min)
51	anterior column posterior hemitransverse	plate/screws, ilioinguinal approach	92.5	97.95
77	both column fracture	plate, ilioinguinal approach	60	29.76
62	anterior column posterior hemitransverse	plate, pararectus approach	37.5	15.96
58	anterior column posterior hemitransverse	plate, ilioinguinal approach	47.5	77.57
59	both column fracture	plate/screws, ilioinguinal approach	42.5	72.85
84	anterior column posterior hemitransverse	plate, ilioinguinal approach	70	226.98
69	anterior column posterior hemitransverse	plate, ilioinguinal approach	110	131.71
70	2-column; displacement posterior	plate, Kocher Langenbeck approach	45	120.08
67	posterior wall	plate/screws, Kocher Langenbeck approach	47.5	93.05
25	posterior wall	plate/screws, Kocher Langenbeck approach	20	46.17

twice weekly training was ordered after discharge. Exclusion criteria were previously existing gait disorders, or impaired mobility before the fracture event, patient that had other injuries interfering with weight-bearing compliance, or the use of crutches, as well as patients below the legal age of 18 and patients with shoe sizes outside the range of 36–45 (EU). Patients were scheduled for follow up at six weeks post surgery. For four weeks postoperative patients were measured with a pressure sensing insole consisting of 13 capacitive pressure sensors, a 3D accelerometer and a temperature sensor was placed in the patients shoe on both sides (OpenGO, Moticon GmbH; Munich, Germany) (2, 3). Maximum weight-bearing per day, as well as the activity time was recorded. Informed consent was obtained from all individual participants included in the study.

RESULTS

In total 10 patients were included into the study (Fig. 1, Table 1). The average age was 62.2 years (range 25–84 years). Measurement data was available for 69 percent of the days. Only 1 patient stayed within the weight-bearing limit during the analysis. Maximum

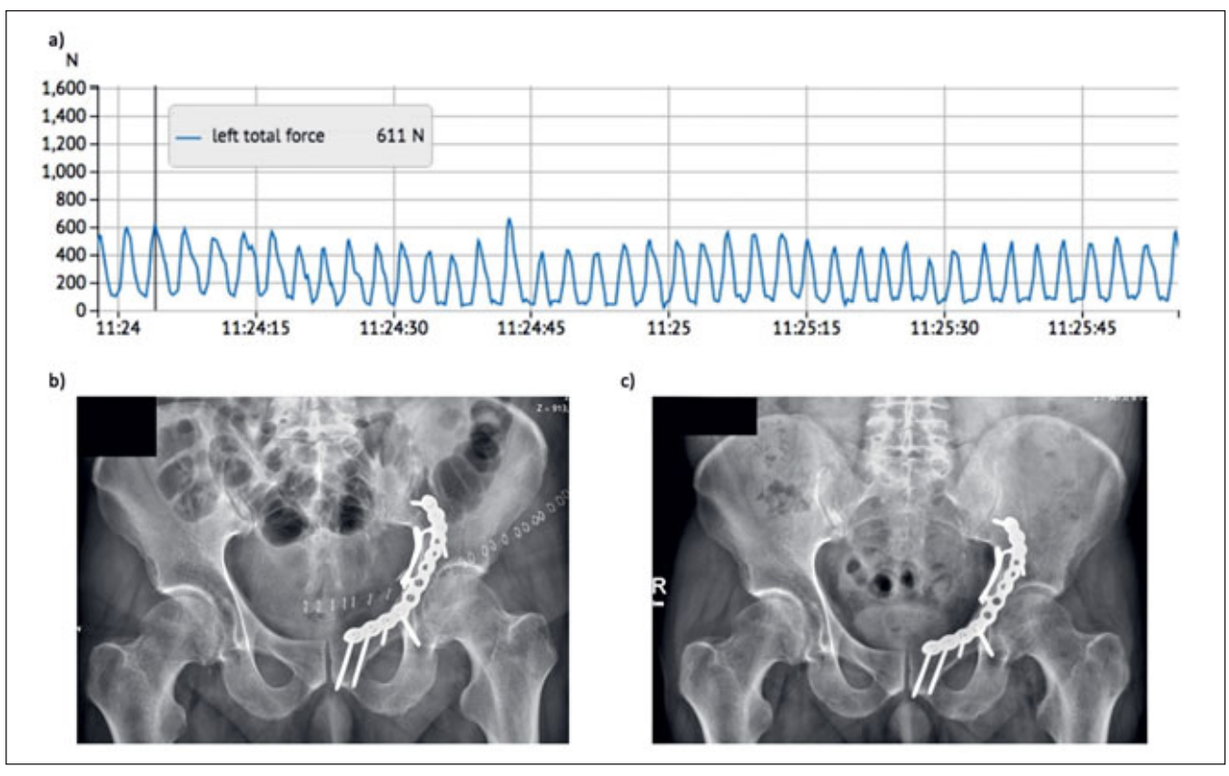

Fig. 1. Exemplary weight bearing data with excess more than triple over the weight-bearing limit is shown (a). No radiographic changes from the immediate postoperative (b) to the follow up (c) radiograph can be seen.

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weight-bearing as high as 110 kg was recorded. On average a maximum of 35.8 kg was recorded (range 0–110 kg) (Fig. 2). The average daily activity recorded was 91.2 minutes (range 16–226 minutes). All patients maintained postoperative reduction at the 6 week timepoint.

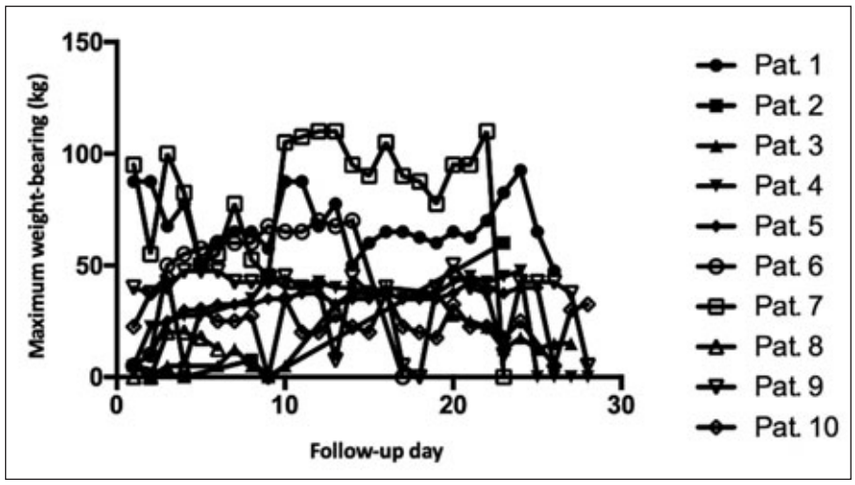

Fig. 2. The graphic shows the maximum weight-bearing reached per day for every patient.

DISCUSSION

Despite the available literature on the limited patient compliance with fixed postoperative weight-bearing restrictions in many other periarticular fractures, most modern local treatment protocols, as well as textbooks and professional societies still base their aftercare recommendations for acetabulum fractures on strict limits (2, 3). Our results provided as part of this brief observational study indicate that even in this severe fracture type patient compliance to these restrictions is low. Maximum weight-bearing in all but one patient exceeded the known limits repeatedly and with a high daily activity average in the early postoperative phase.

Biomechanically, these results do not surprise, as the resulting forces from plantar loading remain well below the actual joint forces in the hip that are recorded during other activities, such as rising from a chair (4,11). These activities of daily living occur often in the aftercare process of acetabulum fracture patients and put a higher strain on the joint than weight-bearing regardless of the limit prescribed during gait. It is thus understandable that the higher plantar loading had no effect on the early radiographic results. Contact forces in the hip are much more dependent on the forces introduced through the musculature and joint angles, than simply on the amount of weight transferred through the foot.

Accordingly, from a biomechanical standpoint permissive physical therapy aftercare regimes seem safe. Other risk factors for reduced outcome have been reported (9,10), yet early or late allowance of weight-bearing in surgically managed acetabulum fractures has not been shown to influence the treatment results (5). Early maintenance of a good reduction is one of the main risk factors for a reduced outcome. This has not been influenced by the weight-bearing behavior observed during the inpatient stay, as well as the free field living conditions after hospital discharge of our patients. Our data furthermore indicates that weight-bearing restrictions that are not continuously controlled cannot be assumed even in severely injured patients and empiric weight-bearing limits are neither met, nor needed by the patient. This is in accordance with early clinical reports of uncontrolled permissive weight-bearing after these fractures(6) and supports current study protocols looking at investigating the effect of controlled permissive weight-bearing in lower extremity injuries in larger patient series.

CONCLUSIONS

The study is certainly limited by its restricted patient number owed in part to the availability of insole material and missing further outcome data. It does however show that despite physical therapy guided instructions and regular training weight-bearing compliance after acetabulum fracture surgery was low. The early radiographic outcome remained unchanged. Further analysis on the use of permissive weight-bearing aftercare regimes are warranted.

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