



## Bilateral posterior fracture dislocation of the shoulders : review of case reports and treatment

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**Bilateral Posterior Fracture Dislocation (BPF) of the shoulder is an uncommon but not rare presentation. We describe etiology, diagnostics, treatments and outcome and give a historic review and with a current approach of this pathology. We reviewed 55 cases (110 shoulders), mostly men (49/55), with a mean age of 49.2 years, mean follow up 21.9 months, mean delay until diagnose of 12.7 days (0-112 days), with a seizure as the cause in 80.0%. Other causes are electrocution, trauma or other. If the mechanism is not clear an epileptic insult should be considered the cause until proven otherwise. Closed reduction or mini open reduction is common in the more dated literature, but gives a overall good outcome. Arthroplasty is the preferred method in the more recent literature. Autografts from the shoulder treated with arthroplasty can be used to reconstruct the articular surface of the contralateral shoulder. High index of suspicion is important and a CT is most important diagnostic tool.**

**Keywords :** bilateral posterior fracture dislocation ; shoulder ; epileptic seizure ; trauma ; electrocution.

### INTRODUCTION

4% of all shoulder dislocations are posterior and 1% of dislocations is associated with fractures (11). Posterior fracture-dislocation represent 0.9% of over 1500 fractures and dislocation of the shoulder in Neer's serie (33). Mynther (32) was the first to report a bilateral posterior dislocation (BPF) of the

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shoulder in 1902 and the highest reported number of known cases of BPF in literature until now is 36 (2,7).

Violent muscular contractions as seen in epileptic seizures lead to adduction and internal rotation of the humeral head. The infraspinatus, teres minor and major, deltoid and latissimus dorsi muscles can co-contract forcefully and cause an posterior glenohumeral dislocation. Continuous spasms in dislocated position can lead to an impaction fracture of the anteromedial humeral head or to comminuted (2- to 4-part) fracture of the proximal humerus (43). Epileptic seizure is the major etiology followed by electrocution. High impact trauma on outstretched arms is another cause (7).

We reviewed 55 cases, the largest number so far, and analysed all the cases in order to define the etiology and how to diagnose and treat BPF.

### METHODS

A search with the terms Bilateral, Posterior, Fracture and Dislocation was done using PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>) and Google

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Scholar (<http://www.scholar.google.com/>). Hits were checked for references.

Cases with a bilateral posterior luxation accompanied by any kind of fracture of the humerus with a description of the patient characteristics were included. English, French, Dutch and German literature was accepted.

Unilateral cases, cases lacking a patient description and/or treatment, locked luxation without explicit mentioning of a fracture of the humeral head, isolated fractures of the glenoid, other languages than mentioned above and untraceable literature despite the excellent tracking of our librarian were excluded.

Nine variables were extracted ; age, sex, etiology, type of fracture, type of diagnostics, delay to diagnosis, type of treatment (primary and final) including surgical approach if described, long term results. We used Excel (Excel 2016 (16.0.6769.2017)) and SPSS (IBM SPSS statistics version 25) to analyze the data. Median and interquartile range are presented for continuous variables. Categorical variables are presented as numbers and percentages. Pearson correlation test for continuous and Spearman correlation test for nominal variables were used for testing correlation. Nominal variables were compared using Chi-Square statistics. For all tests a significance level of  $p=0.05$  was used.

## RESULTS

50 papers describing 60 bilateral posterior fracture dislocations in total were identified. A case (54) of bilateral posterior dislocation was excluded because of isolated fractures of the glenoid fossa. One paper (1) describing 3 bilateral posterior fracture dislocations lacking patients characteristics was excluded. One paper (53) did not describe a treatment and follow up and was also excluded . This made a total of 55 bilateral posterior fracture dislocation of the shoulder (110 shoulders). See table 1 for patients characteristics.

When a patient presents with painful shoulders in internal rotation, adduction and flexion and a inability to externally rotate or abduct the shoulders, this should raise the suspicion of BPF. Especially after an epileptic insult, trauma or electrocution.

Table 1. — Patient characteristics for Bilateral Posterior Fracture Dislocation of the Shoulder

Age	46 (41-60)	
Gender	49 / 6	89.1% / 10.9%
Seizure	44	80.0%
Electric shock	5	9.1%
Trauma	4	7.3%
Other	2	3.6%

Age is defined in years, median and interquartile range are given

Palpation of the shoulder can show a void where the humeral head should be, but this can be difficult to detect because of hematoma or in muscular or obese patients (7,11). X-ray is the most performed diagnostic test but the diagnosis is easily missed on anteroposterior view. Axillary views can confirm the diagnosis but can be difficult to perform due to pain and limited abduction. CT had a sensitivity of 100 percent and can give a detailed view of the fracture(s).

Delay in diagnosis is important. 21 of the 55 patients had a delay of one day to 112 days (mean delay 12.7 days in this serie). 14 of these cases were not recognised clinically and no imaging was asked. In 5 cases the X-rays were misinterpreted and CT confirmed diagnose afterwards (9,21,25,41,47). Patients delay was the cause two times.

Epileptic seizure was the cause in the majority of cases (39/55). Substance use (alcohol deprivation (2) (26,48), overdose amoxapine (36), water intoxication (43), after administration of atropine (35) leading to a seizure was mentioned in 5 cases. Other causes were electrocution (6,10,25,41,49) (5 cases) and trauma (7,17,19,23) (4 cases). In four cases the cause remains unclear : a sudden loss of consciousness with a fall backwards (19) and a fall after a syncope (7) were categorised as trauma but a low impact trauma is not very likely to be the cause of a BPF. A patient found unconscious with a hypoglycemia (40) and a patient with Osteogenesis Imperfecta who was found in his bed without signs of trauma (30) lack a plausible mechanism for the fracture-dislocation.

In only 2 cases (17,23) there was a plausible trauma mechanism : a fall from bicycle on outstretched arms and another fall from motorcycle at 30 miles/hour. This makes trauma as cause of BPF exceptional in this study.

Table 2. — Fracture characteristics

Type of fracture	Right	Left
Articular impression		
<25%	2 (11.1%)	4 (19.0%)
25-50%	14 (77.8%)	16 (76.2%)
>50%	2 (11.1%)	1 (4.8%)
total	18 (32.0%)	21 (38.2%)
2-part	8 (14.5%)	13 (23.6%)
3-part	8 (14.5%)	3 (5.5%)
4-part	12 (21.8%)	9 (16.4%)
Not defined	9 (16.4%)	9 (16.4%)

It is important to know the cause of the epileptic insult ; in this series 3 patients were diagnosed with a brain tumor (12,24,42) afterwards.

Most seen fracture in this serie was an articular surface fracture with an impression of 25-50%. See table 2 for fracture characteristics.

Open reduction and internal fixation is the most performed treatment, although a large variety of internal fixations have been described (plate and screws, just screws, K-wires, sutures). Closed reduction was performed initially in 24 shoulders (22.2%) of which 8 cases (33.3%) needed a second intervention . Arthroplasty was performed 22 times (21 hemi) and was first performed unilateral by Aufranc in 1966 for this indication (5). See table 3 for treatments.

In four cases (21,47,48) contralateral osteochondral autografts were used to reconstruct the humeral

Table 4. — Result of treatment, follow-up 12 months (6-36), N=51, missing 4

Outcome	Right	Left
Poor function, pain	0	0
Poor function no pain	2 (3.6%)	3 (5.5%)
Satisfied	12 (21.8%)	13 (23.6%)
good	24 (43.6%)	24 (43.6%)
excellent	13 (23.6%)	11 (20.0%)
missing	4 (7.3%)	4 (7.3%)

head, while arthroplasty was performed at the donor side. The reconstructed heads gave good to excellent results, better than the side were arthroplasty was done in 3 cases and similar in the fourth (48).

The overall outcome no matter the type of treatment was poor in 5%, satisfied in 23%, good in 48% and excellent in 24%. Our data and analyses could not determine which treatment gives the best results. See table 4. Even supervised neglect can give a good clinical result : a BPDF after trauma returned to work after 4 months, without pain, grade 4 power and able to touch his occiput and lumbosacral region with both hands (23).

A minimal posterior approach was described 3 times in the more dated literature for an open reduction (from 1956 till 1974). In the more recent literature the deltopectoral approach was used 20 times, a superior subacromial approach was promoted by Stableforth (45) and only once the deltoid split was used (22).

Table 3. — Treatment characteristics

Type of treatment	Right 1 <sup>st</sup> treatment	Right 2 <sup>nd</sup> treatment	Left 1 <sup>st</sup> treatment	Left 2 <sup>nd</sup> treatment
Closed reduction	11 (20.0%)		13 (23.6)	
Closed reduction and K-wire fixation	3 (5.5%)		4 (7.3%)	
Open reduction	2 (3.6%)	2 (28.6%)	1 (1.8%)	1 (16.7%)
Open reduction and internal fixation	16 (29.1%)	2 (28.6%)	13 (23.6%)	
Hemi arthroplasty	10 (18.2%)	2 (28.6%)	12 (21.8%)	5 (83.3%)
Reversed arthroplasty	1 (1.8%)			
Supervised neglect	1 (1.8%)		3 (5.5%)	
Reconstruction of humeral head	5 (9.1%)		4 (7.3%)	
McLaughlin Procedure	5 (9.1%)		4 (7.3%)	
Girdle stone	1 (1.8%)		1 (1.8%)	
Arthodesis		1 (14.3%)		
Total	55	7 (12.7%)	55	6 (10.9%)

Table 5. — Correlation analysis, using Pearson for continuous variables, and Spearman for binary and nominal variables

	Outcome right (good/ not good)	Outcome left (good/not good)	Operative / Non-operative Right	Operative / Non-operative Left
Age	0.624	0.263	<b>0.05 (0.266)</b>	0.074
Gender	0.195	0.090	0.259	0.240
Trauma mechanism	0.867	0.893	<b>0.036 (-0.283)</b>	0.151
Epilepsia	0.565	0.268	<b>0.001 (0.429)</b>	<b>0.017 (0.321)</b>
Type injury Right	0.070	<b>0.036 (-0.295)</b>	0.174	
Type injury left	<b>0.033(-0.299)</b>	<b>0.017 (-0.334)</b>		0.675
Impression fracture right	0.266	0.302	<b>0.014 (0.567)</b>	
Impression fracture left	0.484	0.419		<b>0.001 (0.662)</b>
Delay till diagnosis	0.967	0.182	0.442	0.365
1 <sup>st</sup> treatment right	0.808		<b>0.000 (0.461)</b>	
2 <sup>nd</sup> treatment right	0.728			
1 <sup>st</sup> treatment left		0.507		<b>0.000 (0.505)</b>
2 <sup>nd</sup> treatment left		0.704		
Approach	0.962	0.271		

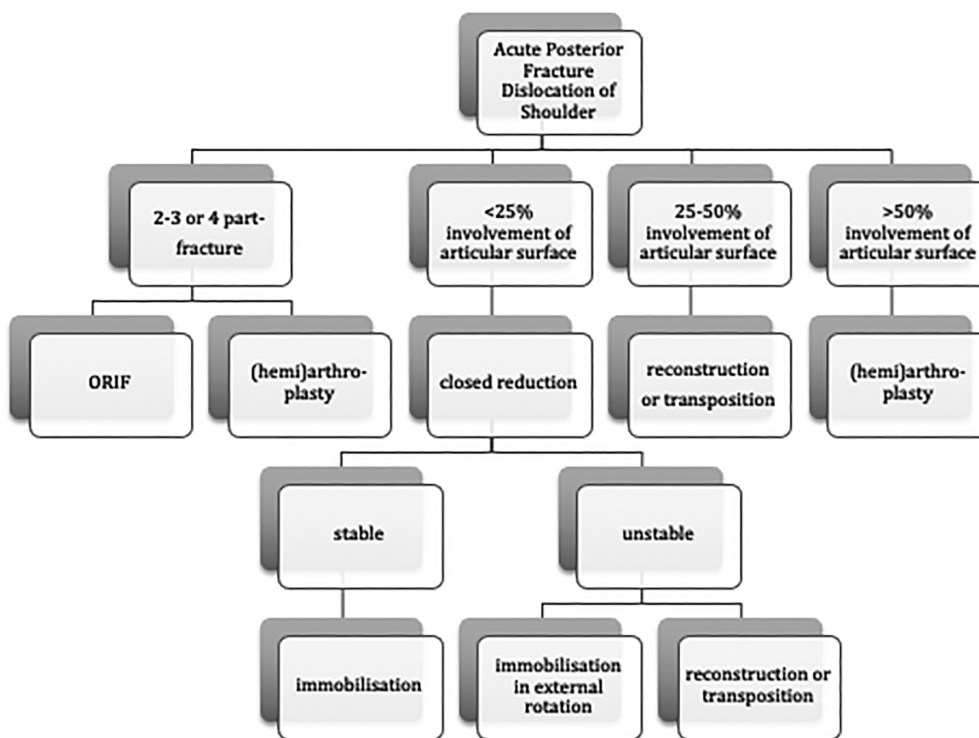


Figure 1.

A bivariate analysis was done on outcome and operative versus nonoperative, compared to all other variables. The outcome is presented in Table 5. No strong correlation was found between patient characteristics, trauma mechanism, type

of injury, delay till diagnosis nor treatment and approach regarding the outcome right or left. On the other hand a strong positive correlation was found for patients with an impression fracture of the humeral head and operative treatment (p=0.014

$r=0.567$ (right) and  $p=0.001$   $r=0.662$ (left)). A split up for impression fracture left and right resulted in a significant and strong positive correlation for left side impression fractures between 25 and 50% ( $p=0.009$   $r=0.553$ ). On the right side no significant correlation ( $p=0.146$ ) could be found.

In result of our findings we suggest a treatment for BPDF presented in a flow chart. See Fig. 1.

## DISCUSSION

A seizure was the cause of the BPDF in 44 out of 55 cases. Alta (2) described two patients with a BPDF of unknown origin without signs of an epileptic seizure initially, who both had a witnessed seizure while hospitalized. In the 4 cases without a plausible cause previously mentioned (19,30,39,54) an epileptic seizure was not ruled out. In such a case we advise to consider the cause to be an epileptic seizure until proven otherwise. An advice of a neurologist is mandatory, including a CT scan of the brain and thorax and abdomen to diagnose a primary or secondary (metastasis) brain tumor (12,24,42) and to medicamentous treat the epilepsy.

Shaw (43) proposed massive contraction of the shoulder girdle muscles forces the humeral head superiorly and posteriorly against the acromion and medially against the glenoid fossa, causing an impression fracture of the medial part of the head. Strong or repetitive contractions can cause fractures of the notched anatomic neck, causing a posterior fracture-dislocation. The cause of these contractions are epileptic seizures most of the times but any kind of strong muscle spasm can be the cause, like seen during electrocution. Probably strong muscle are needed for this mechanism and this may be the reason the data showed predominantly male cases with explicit mentioning of muscularity in 4 cases (19,35,41,44).

A delay till diagnosis up to 4 months is not exceptional, even in the age of the CT-scan. Most important is awareness. Patients complaining of pain in the shoulder after an epileptic insult should have a radiological exam. Especially in case of adduction and internal rotation of the shoulder with a painful and diminished elevation, exorotation or abduction. However clinical signs can be less obvious. Plain

anteroposterior X-ray can be conclusive, but a posterior luxation of the shoulder is easily missed. The 'light bulb sign' or an overlapping in the glenohumeral space can be indicative (17). Axial view can be more conclusive, but this can be painful and/or difficult to perform. Therefore we advise to perform a CT scan when suspicious.

Closed reduction can be the first treatment, but one should bear in mind this can cause a secondary displacement of the fracture (35). If radiological findings show a big incongruity of the humeral head, indicating a difficult repositioning and high likelihood of relapse if repositioned, it is safer to perform an closed reduction under fluoroscopy in the operating room so one can convert to an open procedure easily.

Arthroplasty is a common treatment and is advised when the articular surface is involved for 50% or more (6,20,25). Plating a comminuted fracture of the head can give avascular necrosis (AVN) up to 50% (18). Like any fracture of the proximal humerus the placement of a prosthesis should be avoided when possible because of its durability and poor outcome especially in this relatively young and active population. This may lead to converting an osteosynthesis to an arthroplasty because of AVN, which was seen once in this study (1).

Contralateral osteochondral autografting is a promising technique with good to excellent results and is a good opportunity in this type of injury when one side needs an arthroplasty. All depends on the types of fractures, but when there is a choice the grafting should be done at the dominant side (48).

The overall outcome was surprisingly good, but sometimes difficult to interpret due to lack of measuring instruments in most of the cases. 8 reports (4,10,11,14,21,27,35,41) (10 patients) gave a Constant score, Von Keudell gave a DASH, ASES Shoulder and Mayo elbow performance scores, Mnif (30) gave a UCLU score and Uppal (48) gave Oxford shoulder scores. Most studies did give a detailed ROM, description of limitations and description of return to former activity.

The relative good outcome of the described treatments can be influenced by selection bias and the prevalence is most likely higher because of not reported cases.

Due to the relatively small group and big variation in type of fractures and type of treatment, only correlations could be reported between the type of fracture and treatment. Future studies including more patients will help in establishing the causal relation between the type of fracture and treatment.

### CONCLUSIONS

The typical BPFDD patient is a middle aged man. The main cause for BPFDD is muscular contractions due to epileptic seizure. If the cause is unknown consider a epileptic seizure until proven otherwise. BPFDD is easily missed on clinical examination and/or X ray. If there is a suspicion of seizure or a postictal patient with painful shoulders a CT-scan should be done. Treatment depends on involvement of articular surface. The majority of reported outcome was good to excellent.

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