Surgical therapy of hip-joint empyema. Is the Girdlestone arthroplasty still up to date?

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Abstract

Purpose Hip-joint empyema is a severe local infection that can cause general illness and, in the worst-case scenario, death by septic complications. For severe hip-joint infections, the Girdlestone arthroplasty has been an established treatment option for many decades. We describe functional midterm results after treatment of haematological and postoperative hip-joint infections.

Methods From 2000 to 2010, 24 patients underwent surgical treatment for 27 hip-joint empyemas. The surgical procedures included radical debridement, implantation of local antibiotic beads and soft tissue management. Besides clinical, laboratory and imaging parameters, we analysed the Harris hip score (HHS).

Results Twenty-three patients (26 hips) were followed up after a mean of 30 (3.1–126.8) months. The study group consists of 12 men and 11 women, with an average height of 1.71 m, weight of 84.7 kg and body mass index (BMI) of 28.6 kg/m². Hip-joint empyema was due to haematological septic spread in eight patients, surgery related in 12 hips and other causes in six cases. One patient died due to septic complications during the hospital stay. Intraoperative bacterial culture was positive in 50%, with *Staphylococcus aureus* as the most common organism ($n = 11$). Average hospital stay was 35 days. HHS significantly improved

from 18.2 preoperatively to 47.8 at follow-up. Functional results were mainly poor, but pain relief increased significantly. The infection control rate was 96% with four (15%) complications.

Conclusion Resection arthroplasty by Girdlestone is able to control infection in most cases with an acceptable complication rate but poor functional results. In conclusion, the Girdlestone arthroplasty still is an essential surgical strategy for treating hip-joint empyema in cases in which functional outcome is of lesser priority.

Introduction

Hip-joint empyema is a severe and potentially life-threatening condition caused by endogenous (haematological) or exogenous infection. The mortality rate is reported to be between 7% and 62% [1, 2]. Clinical aspects vary from mild pain without signs of local infection to general septic disease. The endogenous (haematogenous) bacterial type is considerably less common than exogenous (postoperative) hip empyema. Due to its protection by soft tissue, penetrating injuries to the hip joint are very rare [3]. For the same reason, signs of local infection may be missing, even in severely infected joints. Exogenous infection of the hip joint is mainly caused by surgery (hip replacement, osteosynthesis) or local infiltration [4, 5].

G. R. Girdlestone first published a surgical procedure for treating severe hip-joint infection in 1943. He established a more radical surgical treatment due to unsatisfactory results of earlier treatment methods [6].

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This excision arthroplasty of the hip became famous as the Girdlestone arthroplasty. In the past two decades, the procedure gained a new reputation as a salvage procedure for failed hip replacement [1, 2]. There have been several publications about Girdlestone arthroplasties following failed hip replacement [2, 7–9]. In contrast, this paper describes surgical procedures and outcome of patients suffering from hip empyema caused by haematological infection or failed osteosynthesis (postoperative). Little has been published about this issue. [1, 7].

Material and methods

From January 2000 to December 2010, 24 patients (27 hip-joint empyema) underwent the index procedure. All septic complications after hip replacement were excluded from this study. One patient died during his stay in the hospital due to septic shock; 23 patients (26 hips) could be included in this study and re-examined in the follow-up (Figs. 1, 2 and 3).

The medical history of all patients was retrieved, patients were examined [Harris hip score (HSS)], blood analysed [C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), leukocytes] and X-rays were re-evaluated in all cases studied. Surgical procedures were performed following the general rules of septic surgery, including radical debridement/sequestrectomy, tissue management and local and systemic antibiotics. In a second step, reconstructive surgery was performed after an infection-free period of at least six weeks. Surgery was done with the patient in the dorsal or lateral position. All osteosynthesis material was completely removed. Infected and necrotic bone (sequestra) and soft tissue were radically removed and defects filled with gentamicin-polymethyl-methacrylate (PMMA) beads or bone cement. Dynamic (articulating) cement spacers should be used when prosthetic replacement after infection control is

planned [10]. Skin and soft tissue were closed without tension, using local flaps when necessary (Figs. 4 and 5). Vacuum systems were only used in exceptional cases when, following radical debridement, large tissue defects resulted and local flaps could not be used. Specimens and swabs of different tissue layers were collected (minimum five specimens) for bacteriological analyses. Incubation was routinely done for 14 days to detect small-colony variants and slow-growing organisms. Tissue specimens were also collected for histological analysis. Direct attention was paid to characteristic plasma cells, neutrophil granulocytes, lymphocytes, macrophages and a varying degree of marrow cavity oedema and marrow cavity fibrosis in order to make a diagnosis.

Intravenous antibiotics was started during surgery and routinely continued for only seven to ten days. In our view, long-term antibiotics after radical surgical debridement with complete removal of infected tissue, bone and osteosynthesis material is not beneficial. In case of recurrent infection, we prefer early surgical revision rather than long-term antibiotics. In addition to subjective assessment by patients, postoperative results were assessed according to the HSS [11]. To assess fitness of our patients before surgery, we used the American Society of Anaesthesiologists (ASA) physical status classification system [12]. Particular attention was paid to clinical signs of infection locally, such as redness, swelling and hyperthermia, and heterotopically, such as lymphangitis or lymphadenitis.

The data was collected using an Excel spreadsheet (Microsoft Excel, Version Office XP, Microsoft, Richmond, VA, USA). Statistical review was carried out using SPSS (SPSS Inc, Version 16.0.1, Chicago, IL, USA).

Results

The study group consisted of 12 men and 11 women with an average height of 1.71 m (1.49–1.89 m), average weight

Fig. 1 X-ray of a patient with Girdlestone arthroplasty on the left side and chronic hip-joint empyema on the right side, with obvious lysis of the femoral head and acetabulum (a) and postoperative X-ray with Girdlestone situation on both sides (b)

Fig. 2 X-ray of a fracture of the left acetabulum (a). The young patient with massive obesity underwent open reduction internal fixation (ORIF) of the left acetabulum and developed a hip-joint empyema. X-ray view after reduction of antibiotic beads (b)

of 84.7 kg (34–240 kg), and average body mass index (BMI) of 28.6 kg/m² (15.3–71.6 kg/m²). Mean ASA score was 2.9 (2–4). Following the Cierny–Mader Classification, 19 patients were host B and four host A [13]. Prior to the index procedure, patients underwent an average of 2.3 (zero to nine) surgical procedures, including an average 1.5 (zero to seven) septic revisions. Only nine of 23 patients had no prior surgical treatment (Table 1).

The duration of hip-joint infection prior to the index procedure was on average two months (three weeks to

96 months). Hip empyema was a postoperative complication in 12 patients [proximal femoral nail $n=4$, femoral bypass $n=2$, acetabulum open reduction internal fixation (ORIF) $n=2$, screws $n=2$, K wire in femoral-head epiphysiolysis $n=1$, associated with external fixator osteosynthesis $n=1$]. Eight infections were of haematogenous origin, three were caused by intra-articular injections of cortisone and three developed remotely (psoas abscess $n=2$, anal abscess $n=1$) (Table 1). Clinical signs of local inflammation including swelling, redness, hyperthermia and tissue defects (fistula $n=6$, major tissue defects $n=4$) were seen in 15 hips. In contrast, 11 hips showed no signs of local inflammation despite the existence of a severe hip infection (Fig. 3). The preoperative blood analysis showed an increase in CRP in every case, and leucocytosis was found in 18 patients (Table 1). One patient died during hospitalisation, so the mortality rate was 4% (1/24). On X-ray, 24 of 26 hips showed preoperative signs of osteitis such as lyses, sequestra or periosteal reactions (Figs. 1 and 2). Additional imaging methods were re-evaluated in 15 cases: magnetic resonance imaging (MRI $n=6$), computer tomography (CT $n=3$), skeletal scintigraphy ($n=2$) or a combination of these methods (CT plus scintigraphy $n=2$, MRI plus scintigraphy $n=1$, MRI plus CT $n=1$) (Table 1). Average HHS value preoperatively was 18.2 (2–81). Twenty-five hips showed poor results with less than 69 points, and one hip showed good results with 81 points (Fig. 6).

Fig. 3 Different clinical aspects of patients with hip-joint empyema. Right hip region without any pathological findings (a). Fistula within the operation scar of a left hip due to a chronic hip-joint empyema (b). Tissue defect of a left groin caused by chronic inflammation with exposed femoral stent (*) (c). Necrotic and chronic infected amputation stump of a left upper leg with compress still in place (+) (d)

Fig. 4 Intraoperative aspects of surgical revision of hip-joint empyema. Methylene blue staining of the fistula to discover the origin of the inflammation and verify whether the hip joint is involved (a). Picture of an osteolytic femoral head caused by chronic hip-joint empyema (b). Surgical revision of a left hip with chronic inflammation following open reduction internal fixation (ORIF) of the acetabulum; necrotic muscle and soft tissue is visible (c). Trochanteric region (*) and acetabulum osteosynthesis plate (**). After radical debridement and excision of dead tissue, antibiotic beads are inserted into the acetabulum (+) and the former trochanteric region (++) (d)

The average duration of the index operation was 88 (39–136) min. Average hospital stay was 35 (10–173) days. In 13 hips, no evidence of germinal growth was found, in two cases *Staphylococcus epidermidis* was found and in 11 hips *S. aureus* was verified, of these five were identified as Methicillin-resistant *S. aureus* (MRSA), one as MRSA plus *Pseudomonas aeruginosa* and one as MRSA plus *P. aeruginosa* plus *Enterococcus faecalis*. Whereas the average number of previous operations prior to the index procedure was 2.3, this factor increased in the MRSA group to 3.7 (Table 1). In seven of 12 patients with hip empyema

associated with prior surgery, osteosynthesis material was still in place but was loose in every case. Due to infection, a Girdlestone arthroplasty was performed in 18 patients at the time of index operation. For the same reason, one leg amputation with exarticulation of the hip joint was done primarily.

The histological examination confirmed the presence of a hip empyema in all cases studied. Postoperatively, we documented complications in four patients; two local complications—haematoma and fixed antibiotic beads plus a lesion of the sciatic nerve; and three general

Fig. 5 Crossover bypass in left groin infected by Methicillin-resistant *Staphylococcus aureus* (MRSA) with major tissue defect (a), local flap (rectus abdominis flap) as part of our concept of tissue

management in major defects performed by our plastic surgeons after radical debridement of infected tissue (b); postoperative result with closure of left groin without strain (c)

Table 1 General data from study group

Patient	Hip	Sex	Age	BMI (kg/m ²)	ASA	Host	Local signs	Leucocytes ^a	CRP ^b	Fistula	Tissue defect	Origin	Germ	Duration (min)	Girdlestone situation
1	1	M	24	23.1	2	B	No	++	+++	No	No	Postoperative	MRSA	39	No
2	2	M	44	71.6	3	B	Yes	+++	+	Yes	No	Postoperative	MRSA, <i>Pseudomonas aeruginosa</i>	132	Yes
3	3	F	77	31.1	4	B	Yes	+++	+++	No	Yes	Postoperative	MRSA, <i>Pseudomonas aeruginosa</i> , <i>Enterococcus faecalis</i>	47	Yes
4	4	M	49	30.2	2	B	No	-	+	No	No	Haematological	None	97	Yes
5	5	F	27	28.7	2	B	Yes	+	+	No	No	Postoperative	<i>Staphylococcus aureus</i>	96	hip prosthesis
6	6	F	54	34.2	3	B	No	-	+	No	No	Per continuitatem	None	136	Yes
7	7	M	74	20.7	3	B	No	-	++	No	No	Per continuitatem	MRSA	66	Yes
8	8	M	77	26.4	3	B	No	++	++	No	No	Haematological	MRSA	99	Yes
9	9	F	70	29.4	4	B	Yes	+	++	No	No	Haematological	None	43	Yes
9	10	=	=	=	=	=	Yes	++	++	Yes	No	Haematological	None	91	Yes
10	11	M	11	15.3	4	A	No	-	+	No	No	Haematological	None	108	No
11	12	M	52	32.4	4	B	Yes	++	+	Yes	No	Postoperative	None	64	Yes
12	13	F	58	28.7	2	A	No	+	+	No	No	Per continuitatem	None	63	Yes
13	14	F	56	20	3	B	Yes	-	+	No	No	Postoperative	None	89	Hip prosthesis
14	15	M	75	26.1	2	B	Yes	+	+++	No	Yes	Postoperative	None	121	Yes
15	16	F	84	25.8	2	B	Yes	++	+++	No	No	Postinjectionem	<i>Staphylococcus aureus</i>	71	No
16	17	F	74	20	3	A	Yes	++	+	No	Yes	Postinjectionem	<i>Staphylococcus aureus</i>	103	Yes
16	18	=	=	=	=	=	Yes	-	+	Yes	No	Postinjectionem	<i>Staphylococcus aureus</i>	132	Yes
17	19	F	69	34.9	2	B	No	++	+++	No	No	Postoperative	<i>Staphylococcus aureus</i>	86	Yes
18	20	M	16	28	2	B	No	-	+++	No	No	Haematological	<i>Staphylococcus epidermidis</i>	90	Yes
19	21	M	63	25.2	4	B	Yes	++	+	No	Yes	Postoperative	MRSA	59	Yes
20	22	M	37	22.9	3	B	Yes	++	++	No	No	Postoperative	None	105	Yes
21	23	F	43	31.2	4	A	Yes	-	+	Yes	No	Postoperative	<i>Staphylococcus epidermidis</i>	73	Hip prosthesis
22	24	F	76	26	2	B	Yes	++	+++	Yes	No	Postoperative	MRSA	115	Yes
23	25	M	58	25.5	2	B	No	+	+++	No	No	Haematological	None	83	Yes
23	26	=	=	=	3	=	No	+	++	No	No	Haematological	None	89	Yes

^a Leucocytes: reference 5.0–9.0 g/l, + 9.1–10 g/l, ++ 10.1–15 g/l, +++ >15.1 g/l; ^b C-reactive protein (CRP) reference: 0–0.5 mg/dl, + 0.6–5 mg/dl, ++ 5.1–10 mg/dl, +++ >10 mg/dl

Fig. 6 Pre- and postoperative values of the Harris hip score

complications—sacral decubitus ulcer, drug eruption and *Clostridium-difficile*-positive diarrhoea. To control infection, eight hips underwent multiple surgical procedures: seven of these hips showed early reinfection (within six months) and one showed late re-infection (after six months). At the time of follow-up (mean 30 months, range 3.1–126.8), 22 patients (96%) were free of local and/or laboratory detected inflammation signs; one patient (4%) had a persistent fistula. Infection control was thus 96%. Plain radiological follow-up showed no signs of osteitis in any patient. Permanent eradication of inflammation was achieved in 25 of 26 hips; therefore, the Girdlestone arthroplasty was necessary in 23 hips. Three formerly infected hips were preserved; in contrast, three patients needed Girdlestone excision arthroplasty on both sides. After eradication of infection, hip replacement was performed in five of 26 hips; three were still in place at the time of follow-up. Average postoperative HHS value was 47.8 (25–96), with 23 poor, two fair and one excellent outcome. This is a significant increase in HHS value in contrast to the preoperative value (18.2 points). This significant increase was mainly caused by improvement in pain values rather than in functional results (Fig. 6).

Discussion

Septic hip-joint infection is still a severe and potentially life-threatening illness. Literature regarding the functional outcome after Girdlestone arthroplasty is sparse, particularly for haematological hip empyema or infection following failed osteosynthesis. As previously described, the clinical presentation can vary dramati-

ly, from inconspicuous, to a septic state with major tissue defects around the hip. The sum of different parameters, such as clinical features, laboratory values and imaging results (X-ray, MRI, CT, scintigraphy) may pinpoint the diagnosis of hip-joint empyema. We found intraoperative cultures positive for bacterial growth in 50% (13 of 26 hips), which is in line with the literature, especially in previously treated groups [14]. In our group, 14 hips (54%) had preoperative treatment with antibiotics, which may account for the finding of only 50% of positive intraoperative cultures. We found *S. aureus* in 11 positive cultures out of 26 hips, of which, in seven cases, MRSA (alone or in combination) was the most common micro-organism [7, 14, 15].

The Girdlestone arthroplasty was, in our hands, able to control infection in 96% of patients to the time of follow-up, which is similar to published data [1, 2, 7–9, 16, 17]. We found a complication rate of 15%, which seems acceptable at first glance. In our study, 25 patients with hip empyema showed poor preoperative HHS values, which remained poor postoperatively. Whereas functional parameters were not significantly increased by Girdlestone arthroplasty, pain relief and thereby total HHS values increased significantly.

Based on the literature, functional outcome of prosthetic replacement in Girdlestone arthroplasty is unpredictable [14]. These found an average HHS of 62 in 39 hips after conversion, with 23 poor and three very good results. At the time of follow-up, three patients acquired hip replacement with an average HHS of 61 (poor $n=1$, fair $n=2$), which is comparable with the literature. The average HHS of all patients with Girdlestone arthroplasty in our group was 46 (25–96).

In our hands, Girdlestone arthroplasty is still an essential option to control hip empyema. As hip-joint empyema is associated with a high mortality rate, radical surgical treatment can save patients' lives. Functional outcome after Girdlestone arthroplasty is, as expected, poor, but the pain level decreases significantly. Priorities in treatment (infection control, stability, mobility) must be discussed with the patient prior to the treatment. To avoid unrealistic expectations, functional disadvantages of Girdlestone arthroplasty must be discussed in detail. Prosthetic replacement after Girdlestone arthroplasty should be an individual decision in every case, depending on bacterial growth, soft tissue condition and patient age, general condition, etc., as it is associated with high complication rates and mainly poor functional results [14].

Famous words from Girdlestone written in the past century are, surprisingly, still true today: "Whether in war or in peace, the illness is severe, painful and dangerous; its course may prove long, exhausting and bitterly disappointing; its victim greatly needs effective succour....If the operation is well done the relief from illness and distress is dramatic." [6].

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