■ HIP

Debridement and implant retention in the management of hip periprosthetic joint infection

OUTCOMES FOLLOWING GUIDED AND RAPID TREATMENT AT A SINGLE CENTRE

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Aims
To analyse the effectiveness of debridement and implant retention (DAIR) in patients with hip periprosthetic joint infection (PJI) and the relationship to patient characteristics. The outcome was evaluated in hips with confirmed PJI and a follow-up of not less than two years.

Patients and Methods
Patients in whom DAIR was performed were identified from our hip arthroplasty register (between 2004 and 2013). Adherence to criteria for DAIR was assessed according to a previously published algorithm.

Results
DAIR was performed as part of a curative procedure in 46 hips in 42 patients. The mean age was 73.2 years (44.6 to 87.7), including 20 women and 22 men. In 34 hips in 32 patients (73.9%), PJI was confirmed. In 12 hips, the criteria for PJI were not fulfilled and antibiotics stopped. In 41 (89.1%) of all hips and in 32 (94.1%) of the confirmed PJIs, all criteria for DAIR were fulfilled. In patients with exogenous PJI, DAIR was performed not more than three days after referral. In haematogenous infections, the duration of symptoms did not exceed 21 days. In 28 hips, a single debridement and in six hips two surgical debridements were required. In 28 (87.5%) of 32 patients, the total treatment duration was three months. Failure was noted in three hips (9%). Long-term follow-up results (mean 4.0 years, 1.4 to 10) were available in 30 of 34 (88.2%) confirmed PJIs. The overall successful outcome rate was 91% in 34 hips, and 90% in 30 hips with long-term follow-up results.

Conclusion
Prompt surgical treatment with DAIR, following strict diagnostic and therapeutic criteria, in patients with suspected periprosthetic joint infection, can lead to high rates of success in eradicating the infection.

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Periprosthetic joint infection (PJI) is a major complication following total joint arthroplasty. The therapeutic options for treatment and management can be challenging and outcomes may be uncertain. Surgical treatment is usually required and three different options are considered: debridement and implant retention (DAIR), one-stage or two-stage exchange arthroplasty. The published success rates of DAIR procedures range from 16% to 88%.[1-3] This wide range of outcomes may be due to the selection criteria used. Prognostically favourable criteria include: acute infection (less than three-week duration of infective symptoms or within one month of arthroplasty implantation), a stable implant, a pathogen susceptible to a 'biofilm-active' antimicrobial agent and no sinus tract communicating with the joint, and no periprosthetic abscess.[4,5] In our institution, we differentiate between attempts at eradicating infection completely and attempts at controlling or suppressing infection when DAIR is performed. For a curative approach, patients must fulfil all four criteria for a DAIR procedure to be performed. Following surgery, antibiotic treatment continues for a defined period and longer-term monitoring of outcomes is undertaken. We have investigated the effectiveness of DAIR procedures, as the definitive surgical treatment for periprosthetic infection in hip arthroplasty, in our unit, where the primary aim was eradication of infection.

Patients and Methods
Patients who underwent DAIR procedures for suspected PJI were identified from our pro-

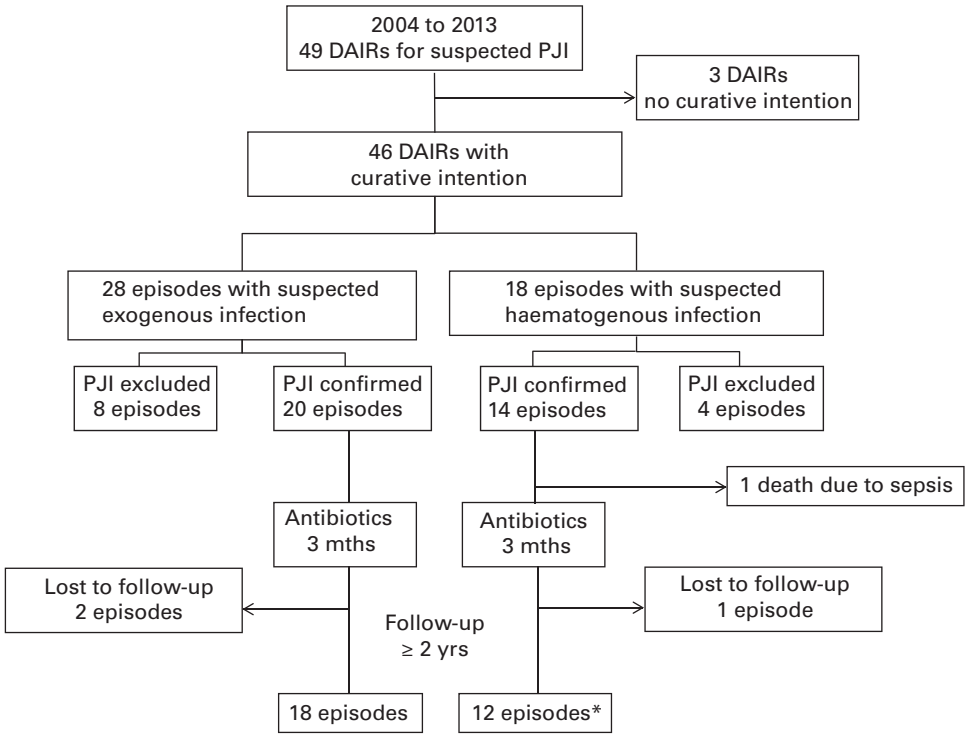

Fig 1

Flowchart showing the grouping of the periprosthetic joint infections (PJI) for treatment analyses and their follow-up period for outcome analyses. (*One patient died 1.4 years after debridement and implant retention (DAIR) from non-infected causes. He was classified as 'probably cured', and in this study was added to the cure group.)

spectively collected hip arthroplasty database, for the period between 1 January 2004 and 31 December 2013. From the surgical findings, the microbiological and histological results, each suspected episode of infection was categorised in either "PJI confirmed" or "PJI excluded" (Fig. 1). An infective episode was defined as PJI in one hip. Thus, a single patient could have multiple infections, if they occurred in both hips, or if an episode re-occurred after a previous infected episode which had been previously classified as eradicated.

The diagnosis of PJI was made by an interdisciplinary team using a standardised protocol of investigation, including microbiology and histopathology results, as described previously from our institution.[6] No intra-operative rapid tests (e.g. alpha defensin test, frozen section for histology) were used. Infections were classified as exogenous or haematogenous PJI. Exogenous (early post-operative) cases included: diagnosis within three months of hip arthroplasty, with clinical findings consistent with surgical site infection, no other identifiable source of infection and no other features in the patient's history to suggest haematogenous spread.[7] A diagnosis of haematogenous PJI was made when there was an acute onset of symptoms (e.g. pain, fever, chills) with or without an obvious distant primary focus of infection, in a patient with an uneventful post-operative follow-up without any intervening symptoms. In addition, cases occurring without any previous symptoms for two or more years after hip arthroplasty were also considered haematogenous.[7] If categorisation was not possible despite a detailed review of the patient's history, the mode of infection was classified as undetermined.

All surgical procedures were performed, or supervised, by consultants working within the Interdisciplinary Unit for Orthopaedic Infections and the hip surgery team at our institution. Specimens for microbiology and histopathology were obtained prior to administration of antibiotics. We applied the following standard protocol for open debridement: as a first step, radical capsular excision of all potentially infected tissues, including heterotopic bone, was performed. Wound irrigation with 3 L to 5 L Lavasept (polyhexanid) (B. Braun Medical, Sempach, Switzerland) using a bulb-syringe was performed. Wound drainage was routinely undertaken and removed 48 to 72 hours after surgery. The decision to retain or exchange modular components was made intra-operatively by the treating surgeon. The femoral head was only retained if head removal would have caused significant damage to the trunnion, or to the adjacent soft tissue and muscles. Liners were exchanged in modular uncemented acetabular components.

Empirical intravenous antibiotic treatment was initiated after obtaining specimens for microbiological analysis and treatment adjusted after the causative organisms and

Table I. Patient characteristics and comorbid conditions in patients in whom debridement and implant retention with an aim of cure was applied between 2004 and 2013

Characteristics	All 46 hips in 42 patients*	Confirmed periprosthetic joint infection - 34 hips in 32 patients†
Demographics		
Mean age (range) (yrs)	73.2 (44.6 to 87.7)	73.2 (44.6 to 87.7)
Women, n (%)	20 (*47.6*)	15 (*46.9*)
Men, n (%)	22 *(52.4)*	17 (*53.1*)
Underlying joint disease	n = 42	n = 32
Osteoarthritis, n (%)	34 *(80.9)*	25 (*78.1*)
Post-traumatic arthritis, n (%)	4 (*9.5*)	4 (*12.5*)
Other, n (%)	4 *(9.5)*	3 (*9.4*)
Arthroplasty	n = 44 joints*	n = 33 joints†
Primary arthroplasty, n (%)	27 (*61.4*)	21 *(63.6*)
Revision arthroplasty, n (%)	17 (*38.6*)	12 (*36.4*)
Comorbid conditions	n = 42	n = 32
Diabetes mellitus, n (%)	10 (*23.8*)	6 (*18.8*)
Immunosuppressive medications,‡ n (%)	3 *(7.1*)	2 (*6.3*)
Malignancy or history of malignancy, n (%)	3 (*7.1*)	2 (*6.3*)
Obesity (BMI > 35 kg/m^2), n (%)	5 *(11.9)*	3 (*9.4*)
Chronic obstructive pulmonary disease	3 (*7.1*)	3 *(9.4*)
Congestive heart failure, n (%)	11 *(26.2)*	7 (*21.8*)
Impaired renal function,§ n (%)	11 (*26.2*)	8 *(25*)
Smoking, n (%)	10 (*23.8*)	6 (*18.8*)
Oral anticoagulants,¶ n (%)	7 (*16.7*)	6 *(18.8*)

*one patient with two infections in two joints (Table III), and one patient with four infections in two joints (Table IV)
† one patient with two infections in two joints (Table III), and one patient with two infections in the same joint (Table IV)
‡ immunosuppressive medications included corticosteroid doses of ≥ 5 mg per day
§ impaired renal function was defined when pre-operative serum creatinine was ≥ 84 μmol/L or estimated GFR was ≤ 50 ml/min
¶ oral anticoagulants included medications with warfarin or rivaroxaban
BMI, body mass index

sensitivities were identified. Antibiotic treatment was stopped, if microbiology or histopathology results were not consistent with the diagnosis of PJI (Fig. 1). In the case of confirmed PJI, the total duration of antibiotic therapy was three months, consisting of one to two weeks intravenous and ten to 11 weeks of oral compounds.

All patients underwent regular clinical and radiological review.[8,9] For patients unable to attend outpatient review, the patients and / or their general practitioners or referring orthopaedic surgeons from other institutions, were contacted by telephone to evaluate the clinical outcome of the patients. The follow-up interval was defined as the time between DAIR and the most recent follow-up. Eradication of infection was considered to have been achieved when follow-up investigations for two or more years following the DAIR procedure showed no evidence of further or ongoing infection.

We included patient characteristics, indications for hip arthroplasty surgery, the clinical presentation of PJI, microbiological and histopathological results, the surgical and antibiotic treatment and the results of follow-up investigations in the analysis. Index surgery was defined as the last elective arthroplasty intervention. The antibiotic treatment included biofilm-active agents, rifampicin for rifampicin-sensitive staphylococci and fluoroquinolones for aerobic Gram-negative bacilli.

Statistical analysis. GraphPad Prism 5.0 was used for statistical analysis (GraphPad Software Inc., La Jolla, California). Student's *t*-test, Fisher's exact test or Pearson chi-squared test were applied where appropriate for parametric or non-parametric data. A two-tailed p-value < 0.05 was considered statistically significant.

Results

DAIR procedures were performed for infection in 49 hips (45 patients) in the study period. Figure 1 shows the process of care and treatment pathways. In three (6%) of 49 hips, DAIR was performed in the presence of chronic infection and these were accordingly excluded from the study. Their treatment had been undertaken without curative expectation and was followed by suppressive antimicrobial treatment. The decision to treat was based on the patient's comorbidities (two patients) and refusal to have removal of hip implants (one patient). In 46 hips (42 patients), DAIR was performed with the aim of eradicating infection. The postulated source of infection was exogenous (early post-operative) in 28 hips and haematogenous in 18 hips.

In 12 of the 46 hips (ten patients), the criteria for PJI were not fulfilled on the basis of the intra-operative findings together with negative microbiological and histopathological results. These cases were categorised as "PJI excluded" (Fig. 1). In all 12 hips, empirical antimicrobial

Table II. Identified microorganisms in confirmed periprosthetic joint infection treated with debridement and implant retention

	Exogenous route (early post-operative)*	Haematogenous route	Total*
Hips (n)	20	14	34
Bacteraemia, n (%)	0	9 (*64.3*)	9 (*26.5*)
Monomicrobial infections, n (%)	12 (*60*)	14 (*100*)	26 (*76.5*)
Polymicrobial infections, n (%)	8 (*40*)	0	8 (*23.5*)
Coagulase-negative staphylococci, n (%)	11 (*55*)	0	11 (*32.4*)
Staphylococcus aureus, n (%)	5 (*25*)	5 (*35.7*)	10 (*29.4*)
Enterobacteriaceae,† n (%)	7 (*35*)	1 (*7.1*)	8 (*23.5*)
Streptococcus spp., n (%)	0	8 (*57.1*)	8 (*23.5*)
Pseudomonas aeruginosa, n (%)	1 (*5*)	0	1 (*2.9*)
Enterococcus faecalis, n (%)	1 (*5*)	0	1 (*2.9*)
Bacillus spp., n (%)	1 (*5*)	0	1 (*2.9*)

*numbers in column add up to more than 100% (i.e., 20 and 34, respectively) because of polymicrobial infections
† identified species among *Enterobacteriacae* included *Citrobacter koseri, Proteus mirabilis, Klebsiella oxytoca, Escherichia coli, Morganella morganii* and *Enterobacter cloacae*

treatment was stopped within two weeks, and monitoring of outcomes undertaken. A total of ten of 12 hips showed no evidence of infection after two years; one hip showed no evidence of infection after one year, but no further follow-up data was available. A further one patient died at 5.5 months after the DAIR procedure from an unrelated cause.

Among the 34 hips (32 patients) with confirmed PJI, three patients (three hips) died between one and five months after DAIR from non-infection causes. Prior to their death, there were no signs of persisting PJI. Thus, 31 hips with proven PJI (29 patients) in which DAIR was performed were available for outcome analyses. A patient (one hip) died due to the complications of sepsis, six days after DAIR and was classified as 'failure' in the outcome analyses and one patient died 1.4 years after DAIR from an unrelated cause. This case was considered cured and added to the analysis. Hence, 30 hips (28 patients) with proven PJI and with long-term follow-up results were available for analysis (Fig. 1).

Patient characteristics are summarised in Table I. Osteoarthritis was the most common indication for an arthroplasty and almost two thirds of the patients had a primary arthroplasty. We did not identify variables among the comorbid factors that were significantly more frequent among confirmed and excluded PJIs.

Exogenous (early post-operative) PJI was diagnosed in 20 hips, and haematogenous PJI in 14. Exogenous infections were often polymicrobial, but predominately caused by coagulase-negative *Staphylococci*. All haematogenous infections were monomicrobial and mainly caused by *Staphylococcus (S.) aureus* and *Streptococcus* spp. (Table II).

In exogenous infections, the time from index hip arthroplasty to DAIR procedure was ≤ 30 days in 95% (19 hips) of the 20 PJI confirmed cases (Table III). In one remaining hip, it was 49 days. Clinically, all hips had shown either poor wound healing, persistent wound oozing and or wound breakdown. The decision to perform DAIR was taken early. In eight hips (40%) of the confirmed exogenous PJI cases, the decision was made while the patient was still in hospital. In the remaining 12 cases (60%), DAIR was performed within three days after referral.

In 14 hips with PJIs classified as haematogenous origin, the duration of symptoms until DAIR was ≤ 21 days (Table IV). Bacteraemia was proven in nine of 14 (64.3%) PJIs.

In the vast majority of PJIs, only one debridement was performed, regardless of the route of infection (Tables III and IV). Modular components were exchanged in 27 of 46 hips (58.7%). There was a significant difference between the groups undergoing modular component exchanges between "PJI confirmed" (24 of 34, 70.6%) and "PJI excluded" (3 of 12, 25%) (chi-squared test, p = 0.015). This was also true for the 28 cases that were categorised as exogenous infections (15 of 20; 75% "PJI confirmed" *versus* 2 of 8; 25% "PJI excluded", (chi-squared test, p = 0.03).

Antibiotics with activity against biofilm-producing bacteria were administered in all cases in which a corresponding susceptible microorganism was identified. With the exception of four patients, the treatment duration was for three months in all cases. A total of three of these four patients died after six, 42 and 45 days, respectively. In one patient, the treatment duration was 200 days (Tables III and IV).

In 41 (89.1%) of all the PJIs suspected, and in 32 hips (94.1%) with confirmed PJIs, all criteria for DAIR were met. In five hips not all criteria were met. In four cases that were categorised in the exogenous group (1 x "PJI confirmed" plus 3 x "PJI excluded"), the interval between implantation and DAIR was > 30 days (40 to 51) (Table III). In one haematogenous case, a sinus tract communicating from the joint to the muscles was found (Table IV).

During the follow-up period, two failures were noted. Both occurred in the haematogenous group and were both caused by *S. aureus*. One failure occurred four weeks after the DAIR procedure. The patient refused further surgery and antimicrobial suppressive therapy was administered. The second failure was a relapse four months after DAIR and one month after cessation of antibiotics. This patient underwent a one-stage exchange arthroplasty and was free of infection at last review.

Table III. Criteria for debridement and implant retention (DAIR) and treatment characteristics in exogenous (early post-operative) periprosthetic joint infection (PJI)

Characteristics	All hips	Confirmed PJI	Confirmed PJI with ≥ 2 yr follow-up
Cases (n)	28	20	18
Patients (n)*	27	19	17
Implant age†			
Mean (range) (days)	21.4 (7 to 51)	20.2 (7 to 49)	20.9 (7 to 49)
≤ 30 days, n (%)	24 *(85.7)*	19 (*95*)	17 (*94.4*)
> 30 days, n (%)	4 (*14.3*)	1 (*5*)	1 (*5.6*)
Decision to perform DAIR, n, (%)			
During hospitalisation for index surgery‡	12 (*42.9*)	8 (*40*)	7 (*38.9*)
Referred§	16 (*57.1*)	12 (*60*)	11 (*61.1*)
Mean time interval from referral to DAIR, (range) (days)	1.3 (0 to 4)	1.1 (0 to 3)	1.1 (0 to 3)
Surgical therapy			
Debridements (n)	1 in 25 hips; 2 in 3 hips	1 in 17 hips; 2 in 3 hips	1 in 15 hips; 2 in 3 hips
Exchange of modular components, n (%)	17 (*60.7*)	15 (*75*)	14 (*77.8*)
Microorganisms,¶ n (%)			
Rif–S *Staphylococci*		14 (*70*)	12 (*66.7*)
FQ-S aerobic GN rods		8 *(40)*	7 (*38.9*)
Directed antimicrobial treatment			
Duration, mean (range) (days)		94.8 (45** to 117)	98.1 (90 to 117)
Use of Rif for Rif-S *Staphylococci* (%)		100	100††
Use of FQ for FQ–S aerobic GN bacilli (%)		100	100
Follow-up			
Duration, mean (range) (yrs)‡‡		3.0 (0.1§§ to 6.5)	3.3 (2.0 to 6.5)
Outcome cases			
Failure		0	
Cure			18

All hips consists of "PJI confirmed" plus "PJI excluded". Unless otherwise indicated, the values are presented as the number of hips with the proportions in parentheses corresponding to the total number of hips
* one patient had two confirmed PJIs, one each after total hip arthroplasty at each body site (2010, 2012)
† the time interval was calculated from index surgery until the date of the first DAIR intervention
‡ index surgery was defined as the previous elective intervention for joint reconstruction (e.g. implantation of hip arthroplasty)
§re-referral after discharge of hospitalisation for index surgery
¶ the numbers and proportions add up to more than 100% because of polymicrobial infections
** one patient died 45 days after DAIR from a non-infected cause
†† one patient did not tolerate treatment with rifampicin. Treatment was switched after 6 wks
‡‡ the time interval from DAIR to the date of the latest follow-up investigation
§§ two patients (each one infection episode) died 45 (see **) and 148 days after DAIR from non-infection causes. These were classified as lost to follow-up (Fig. 1)
Rif, rifampicin; FQ, fluoroquinolone; S, susceptible; GN, gram-negative

The overall results show a successful outcome, with a mean follow-up of 4.0 years (1.4 to 10), of 91% (100% in the exogenous group, 0 failures, 78.6% in the haematogenous group, three failures).

Discussion

The incidence of PJI is increasing.[10,11] Its treatment requires specific knowledge and an experienced multidisciplinary team. Most centres, specialising in the management of PJI, follow similar diagnostic pathways. However, the criteria used may differ between different centres and countries. We believe the difference in the reported success rates for DAIR procedures between different units is likely to be explained by this variation. If eradication of infection is the primary aim, following strict criteria and protocols is necessary to obtain the best outcomes.

Key among the criteria for a successful DAIR, is the time interval between implantation, in early post-operative infections and the duration of symptoms in haematogenous PJI.[4,5] The rationale for this, is based on the duration of biofilm formation. According to *in vitro* data, killing of device-associated bacteria depends on the age of the biofilm.[12] Barberán et al[13] showed that the success rate of DAIR dropped from 83.4% to 65.2% and 30.8%, respectively, when the duration of infection increased from less than one month to two to six months, and to more than six months, respectively.

Exogenous infections typically manifest with local signs and symptoms at the site of previous surgical intervention.[7] Clinical signs of sepsis are often absent and laboratory parameters for systemic inflammation are often unremarkable or difficult to interpret. These parameters are often not helpful in the decision-making process between watchful waiting or early surgical intervention. Persisting wound management issues, wound oozing and wound breakdown all point towards early PJI.[14,15] In a case-control study, post-operative surgical site infection had a matched odds ratio of 35.9 (95% confidence interval 8.3 to 154.6) for PJI.[15] On the basis of these observations, the threshold to perform DAIR early, in the case of persistent wound prob-

Table IV. Criteria for debridement and implant retention (DAIR) and treatment characteristics in haematogenous periprosthetic joint infection (PJI)

Characteristics	All cases	Confirmed PJI	Confirmed PJI with ≥ 2 yr follow-up*
Cases (n)	18	14	12
Patients (n)*	15	13	11**
Duration of symptoms†			
Mean (range) (days)	4 (1 to13)	4 (1 to 13)	3 (1 to 13)
≤ 21 days, n (%)	18 (*100*)	14 (*100*)	12 (*100*)
Mean time intervals (days)			
From referral to DAIR (range)	3 (0 to 11)	4 (0 to 11)	4 (0 to 11)
From onset of symptoms to DAIR (range)	7 (1 to 21)	8 (1 to 21)	8 (1 to 21)
Condition of soft tissue surrounding the implant			
Presence of a sinus tract, n (%)	1 (*5.9*)	1 (*7.7*)	1 (*8.3*)
Surgical therapy			
Debridements (n)	1 in 14 hips; 2 in 4 hips	1 in 11 hips; 2 in 3 hips	1 in 9 hips; 2 in 3 hips
Exchange of modular components, n (%)	10 (*55.6*)	9 (*64.3*)	8 (*66.6*)
Microorganisms, n (%)			
Rif–S *Staphylococci*		5 (*38.5*)	4 (*33.3*)
FQ-S aerobic GN rods		1 (*7.7*)	1 (*8.3*)
Directed antimicrobial treatment			
Duration, mean (range) (days)		92.9 (6‡, 42‡ to 200§)	97.2 (62 to 200§)
Use of Rif for Rif–S *Staphylococci* (%)		*100*	*100*
Use of FQ for FQ–S aerobic GN bacilli (%)		*100*	*100*
Follow-up			
Duration, mean (range) (yrs)¶		4.3 (0.01‡, 0.1‡ to 10.0)	5.0 (1.4**; 2.0 to 10.0)
Outcome by hips			
Failure		3	
Cure			10

Unless otherwise indicated, the values are presented as the number of cases with the proportions in parentheses corresponding to the total number of cases

*over the ten-year period, one patient had four suspected cases. Two haematogenous PJIs were proven (2004, 2013) with two different microorganisms. In 2008, he had an episode simultaneously involving both hips. PJI was excluded and antimicrobial treatment was stopped

†the time interval was calculated from the onset of symptoms to the date of referral

‡one patient died six days, one 42 days after DAIR (each one infection episode). They were classified as failure and lost to follow-up, respectively (Fig. 1)

§one patient was treated for 200 days. The range of the other confirmed cases was 62 to 101 days

¶ the time interval from DAIR to the date of the latest follow-up investigation

**one patient died 1.4 years after DAIR from non-infection causes. He was classified as probably cured, and in this study was added to the cure group

Rif, rifampicin; FQ, fluoroquinolone; S, susceptible; GN, gram-negative

lems or secondary wound discharge, is low at our institution. As a consequence of this strategy, eight of 28 cases (28.6%) in the exogenous group underwent early surgical intervention, but PJI was not confirmed.

At our institution, following elective joint arthroplasty, patients are not discharged until the wound is completely dry. In all, 12 hips underwent DAIR procedures during the same hospital episode as their primary arthroplasty. These patients may have not received early surgery, if early hospital discharge was a priority.[16] Prolonged hospitalisation after hip arthroplasty is associated with higher costs. A policy of not discharging patients with incompletely healed wounds increases the opportunity for early intervention in patients when wound problems ensue. Delay in the diagnosis of PJI reduces the chance of curative DAIR and increases the risk of the need for exchange arthroplasty and its associated higher risks and costs.[10,17]

After hospital discharge, following elective surgery; patients, their general practitioners and carers are advised to immediately contact our institution, if there are concerns about possible joint infection. These referrals are evaluated for urgent surgery. In our study the vast majority of patients received DAIR within 72 hours of presentation (Tables III and IV). A possible explanation for the different outcome results from our centre and that of others may be the rapid response we offer.[18-20]

Meticulous open debridement in a single surgical intervention by specialised surgeons facilitated cure in the majority of cases. This observation supports the importance of meticulous surgery in the first attempt, because with each treatment failure, further tissue damage und functional compromise occurs.[21] The role of the exchange of modular components could not be evaluated in our study due to the overall high cure rate and the small numbers studied. Exchange of modular components, if feasible, is recommended, although this recommendation is based on empirical reasoning only. Further trials are necessary to evaluate the influence of the exchange of modular components in the overall success of DAIR procedures.

The level of compliance with our strict criteria for DAIR was high. In five cases, including only two confirmed PJIs, not all criteria for DAIR were fulfilled. In our view, this level of compliance contributed to the high success rate we report. However, we could not draw a statistical association between cases treated with all criteria for DAIR fulfilled and outcomes due to the lack of a comparison group.

In two haematogenous cases, failure with *S. aureus* were noted. Previous studies have indicated that the risk of failure is higher when *S. aureus* (in comparison with other pathogens) is involved.[22]

A major weakness in our study is the relatively small numbers studied. Large studies are difficult to conduct in individual centres and multi-centre trials would address this, though create potential increased variability in the clinical and surgical decision making. Nonetheless, only a few studies on DAIR in PJI of the hip have included more cases.[1]

In conclusion, we report the outcome of DAIR in our institution for PJI with a successful outcome of 91% in 34 hips, and 90% in 30 hips with long-term follow-up results. We believe the key to success is strict application of the surgical criteria, rapid access to treatment, and meticulous surgical technique.

Take home message:

- In patients with periprosthetic joint infections, debridement and retention of implant followed by a three-month course of antibiotics has a high cure rate, provided that strict adherence to all criteria for this treatment concept has been applied.

Author contributions:
P. Sendi: Obtained patient data, Developed the study design, Data analysis, Writing the paper.
P. O. Lötscher: Obtained patient data, Writing the paper.
B. Kessler: Clinical responsibility for patients, Writing the paper.
P. Graber: Clinical responsibility for patients, Contributed to the generation of the data and cohort data bank.
W. Zimmerli: Data analysis, Contributed to the generation of the data and cohort data bank, Writing the paper.
M. Clauss: Clinical responsibility for patients, Data analysis, Contributed to the generation of the data and cohort data bank, Writing the paper.

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