Contemporary outcomes of debridement, antibiotics and implant retention (DAIR) in hip arthroplasty

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Abstract: A debridement, antibiotic-treatment and implant-retention (DAIR) is a valuable surgical option in the treatment of hip periprosthetic joint infection (PJI). Although the indications for DAIR remain controversial, it should be considered in all hip PJI cases with a soundly fixed prosthesis, despite chronicity and type of implant. DAIR is associated with significant reduced cost and better patient reported outcomes compared to 2-stage revision. Variable success, defined as eradication of infection, has been reported following DAIR (14% to 100%) which is partly due to heterogeneity of the cohorts reported, the length of follow-up and the various definitions of success used. The success following DAIR has continuously improved since 2004, with a pooled mean chance of success of 72.2%. A number of variables have been associated with chances of success that need to be considered, when surgeons decide to proceed with a DAIR. Those can be broadly divided into patient-, PJI-, surgical- and antibiotic-related factors; all of which are covered in this review. It is our opinion that a DAIR can achieve PJI eradication in the majority of patients in the hands of experienced surgeons in specialised centres with a multi-disciplinary team approach. Exchange of modular components and thorough debridement are paramount.

Keywords: Hip; periprosthetic joint infection (PJI); antibiotic-treatment and implant-retention (DAIR); outcome

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Introduction

The incidence of hip periprosthetic joint infection (PJI) is thought to be 0.5% to 2% (1). As a result, PJI is one of the leading causes of revision following hip arthroplasty. Given the projected increase in hip arthroplasty volume, the burden of PJI is likely to increase in the future. PJI is a devastating complication following THA, for the patient, the surgeon, the healthcare system and the society overall. It is associated with reduced patient outcome [as measured by morbidity-, mortality-rates (2) and quality of life measures (3)] and increased cost (4). It is also an incommensurable psychosocial stressor for the patients, as the fear of disease progression is comparable to that seen in oncology patients (5).

Although indications for a debridement, antibiotic-treatment and implant-retention (DAIR), remain controversial, it is a surgical procedure that one ought to consider in the treatment of PJI. In this review article we aim to (I) provide the reader with a brief, contemporary, description of a DAIR; (II) define outcomes described in the literature; and (III) describe factors associated with improved chances of success.

What is a DAIR?

History

Coventry was amongst the first to describe what a DAIR procedure entails "radical debridement of all necrotic debris"; when it should not be considered, "when the components were loose, or bone involvement was present"; and what the post-operative regimen should entail, "patients were treated with irrigation with an appropriate antibiotic and were maintained on high doses of parenteral antibiotics for as long as possible" (6).

Description of technique

During a DAIR, the surgical team, would excise all infected (or potentially infected) tissue along all tissue planes, i.e., from the skin down to the prosthesis. Thus, the procedure would typically involve a radical debridement of involved skin, excision of any sinus tracts present, inflammatory tissues present superficial and deep to the fascia lata, a debridement of the capsule and the synovium along with any inflammatory tissue around the prostheses. Copious irrigation and exchange of modular components are strongly advised (7). A DAIR is not a simple arthrotomy or incision and drainage or washout. Although a DAIR is considered, the least invasive surgical option, it may be associated with significant blood loss due to the extensive dissection ('to healthy bleeding tissue') that is necessary for adequate debridement. Post-operative hemoglobin levels are similar to those seen after revision arthroplasty and half of patients require blood transfusion (8). In addition, it is our opinion that it is best performed by an arthroplasty surgeon who would be more comfortable to perform the radical excision in order to achieve the necessary debridement. It is crucial to assess the integrity of the interfaces (bone implant and bone-cement when present) as a compromised interface will reduce chances of success.

Although surgery is an important part of the DAIR, so is the medical aspect of treatment. Patient optimization pre- and post-procedure, along with appropriate antibiotic guidance lead by infection disease physicians is paramount. Broad spectrum antibiotic therapy should be used whilst culture results are pending. Once the pathogen is known, treatment regimen and duration should be agreed upon by the surgical and medical teams. Total duration of antibiotic therapy varies greatly in the literature, from six weeks to six months, but treatment should always be tailored to the patient (9,10). There is some evidence that treatment for longer than three months only delays failure rather than decreases the risk of failure (11).

The use of bio-absorbable antibiotic carriers (e.g., calcium sulphate or resorbable sponges) is becoming increasingly popular to deliver high doses of antibiotics locally, but no high-level evidence is at present available regarding the efficacy of such adjuvants in the literature.

Multi-disciplinary aspect

It is key that these patients are treated by a multidisciplinary team. Ideally, this would include specialist nurses, therapists (physiotherapists, occupational therapists), infectious disease physicians, and plastic surgeons in addition to the orthopedic team.

DAIR in hip arthroplasty

DAIR should be considered in all hip PJI cases, despite chronicity, with well-fixed implant and sound interfaces (implant-bone or implant-cement/cement-bone) (12).

DAIR in primary total hip arthroplasty

Success rates following DAIR have been quite varied (14% to 100%), which is partly due to heterogeneity of the cohorts reported, the length of follow-up and the various definitions of success (13-21) (*Table 1*).

The most comprehensive definition of PJI eradication is at present the modified Delphi criteria, described in the recent International Consensus (10). However, whether this is fully applicable for a DAIR can be a matter of debate as in several series, authors have advocated more than one debridement procedure as part of the 'DAIR approach'. Thus, a repeat procedure would be considered as failure of treatment as per the modified Delphi criteria. It is our opinion, that in cases of desired PJI eradication a second DAIR procedure is only moderately likely to be a success and hence, strong consideration should be given to revision arthroplasty if the patient can tolerate the procedure.

The studies reporting on outcomes after DAIR are predominantly of small cohorts, and most of them are of retrospective design. In a systematic review of 39 case-control and cohort studies from 1971 to 2016 that included 1,296 patients, Tsang *et al.* reported that the success following DAIR has continuously improved since 2004. The

Table 1 Previous studies (1998–onwards) reporting on outcome following DAIR

Study	Joint	No of cases [hips]	Follow-up/years, mean [range]	Success %	Exchanged modular parts	Most common organism	Complication rate	Predictors of poor outcome
Crockarell *et al.* 1998	Hip	42	6 [0–22]	26	No	CoNS (11%)	12%	n/a
Tattevin *et al.* 1999	Hip/knee	34	2 [0–6]	38	No	*S. Aureus* (74%)	n/a	Symptoms >5 days
Krasin *et al.* 2001	Hip	7	2.5	29	No	Gram+	n/a	n/a
Meehan *et al.* 2003	Hip/knee	19 [6]	4 [0–22]	90	26%	Group G Strep	n/a	n/a
Soriano *et al.* 2003	Hip	10	2	90	No	Mixed	n/a	n/a
Berdal *et al.* 2005	Hip/knee	29 [20]	2	83	Yes	*S. Aureus* (62%)	n/a	n/a
Marculescu *et al.* 2006	Hip/knee	99 [47]	2 [1–8]	60	48%	*S. Aureus* (32%)	n/a	Sinus tract, symptoms >5 days
Theis *et al.* 2004	Hip	36	4.5	53	No	Gram+	n/a	n/a
Aboltins *et al.* 2007	Hip/knee	20 [13]	2 [1–6]	88	Yes	MRSA (50%)	n/a	n/a
Martinez-Paster *et al.* 2009	Hip/knee	47 [15]	1 [1–3]	75	Yes	*Enterobacteria* (87%)[x]	n/a	CRP
Parvisi *et al.* 2009	Hip	24	Min 2	33	No	Gram+	n/a	n/a
Byren *et al.* 2009	Hip/knee	112 [52]	n/a	81	n/a	*S. Aureus* (42%)	n/a	Revisions, arthroscopic washout, *S. aureus*
Tintle *et al.* 2009	Hip	3	3	100	Yes	Mixed	n/a	n/a
Aboltins *et al.* 2011	Hip/knee	17 [15]	2 [0–8]	88	Yes	*E. Coli* (30%)[x]	n/a	n/a
Azzam *et al.* 2010	Hip/knee	106 [53]	6 [2–10]	66	29%	*Staphylococcal* (46%)	n/a	*Staphylococcus*, high ASA, Frank pus
Van Kleunen *et al.* 2010	Hip/knee	18 [13]	3 [1–5]	72	72%	MSSA (50%)	n/a	Surgery after 4 weeks from implantation
Estes *et al.* 2010	Hip/knee	20 [4]	4 [1–8]	90	Yes	MSSA (20%)	n/a	n/a
Cobo *et al.* 2010	Hip/knee	117 [69]	2 [0–3]	57	Yes	*S. Aureus* (40%)	n/a	Centre ‘C’ (1 of 9 centres in study)
Klouche *et al.* 2011	Hip	12	3 [2–4]	75	18%	*Streptococci* (58%)	n/a	n/a
Koyonos *et al.* 2011	Hip/knee	138 [60]	5 [1–10]	35	No	*Staphylococcal*	n/a	*Staphylococcus*, chronic infection
Choi *et al.* 2012	Hip	28	5 [1–10]	68	68%	*S. Aureus* (25%)	n/a	Revision, polymicrobial, *S. aureus*
Sukeik *et al.* 2012	Hip	26	7 [5–11]	77	Yes	*S. Aureus* (31%)	n/a	Symptoms >5 days
Buller *et al.* 2012	Hip/knee	309 [62]	3 [0–13]	52	Partly	CoNS (20%)	n/a	Symptoms >21 days, *Staphylococcus*

Table 1 (*continued*)

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Study	Joint	No of cases [hips]	Follow-up/years, mean [range]	Success %	Exchanged modular parts	Most common organism	Complication rate	Predictors of poor outcome
Geurts *et al.* 2013	Hip	69	2	83	No	Gram+	n/a	Delay of treatment ≥8 weeks
Peel *et al.* 2013	Hip	28	2.5	71	Yes	Gram+	n/a	n/a
Westberg *et al.* 2013	Hip	38	4 [1–10]	71	Yes	*S. Aureus* (26%)	42%	Polymicrobial infection
Kuiper *et al.* 2013	Hip/knee	91 [62]	3 [0–6]	66	Most	*S. Aureus*	n/a	CoNS, late infection, symptoms >7 days
Konigsberg *et al.* 2014	Hip	42 [20]	4.5	80	Yes	Gram+	n/a	*Staphylococcus*
Betz *et al.* 2014	Hip	38	3.5	82	Yes	Gram+	n/a	*Staphylococcus aureus*
Moojen *et al.* 2014	Hip	33	4	88	Yes	Gram+	n/a	n/a
Triantafyllopoulos *et al.* 2015	Hip	60	5 [1–14]	70	Yes	MSSA (30%)	n/a	Symptoms >5 days, BMI, MRSA
Tornero *et al.* 2015	Hip/knee	222 [87]	0.2	77	73%	CoNS	n/a	Kidney/liver failure, revision, CRP, cemented
Chaussade *et al.* 2017	Hip/knee	87 [60]	4	69	Yes	Mixed	n/a	*Staph. aureus*
Grammatopoulos *et al.* 2017	Hip	82	8	85	55%	Mixed	43%	Symptoms > 7 days, no exchange of modular components, loose components
Barros *et al.* 2019	Hip/knee	38 [12]	3.5	89.50	Yes	Mixed	n/a	Late treatment, no exchange of components

Success defined as infection eradication. [x], study involving Gram-ve organisms only. Strep, Streptococcus; MRSA, methicillin resistant Staphylococcus aureus; MSSA, methicillin sensitive Staphylococcus aureus, CoNS: coagulase negative Staphylococcus; DAIR, antibiotic-treatment and implant-retention.

overall chance of success was 72.2% (21). As the authors pointed out, this may be due to a learning effect following the paper by Zimmerli that better defined treatment algorithms and management in PJI (22). Improved success was noted when DAIRs were performed early (<7 days; 75.7%) and when the modular components were exchanged as part of the procedure (77.5%).

We have previously reported a PJI-center's institutional experience with 122 THA DAIRs (7,12). Overall, eradication was seen in 68% with the initial DAIR. In 32 cases, additional DAIR(s) was required. Infection eradication was seen in 85% of cases (104/122) when single or multiple DAIRs were performed. Of the twenty-one hips that underwent revision (17%), the majority (n=16) were for persistent PJI. In this cohort, the 10-year implant survivorship was 77%. Factors independently associated with a 4-fold increased PJI eradication and improved implant survivorship with DAIR were (1) early PJI and (2) exchange of modular components. We also reported a study comparing 3 case-matched groups; primary THAs, DAIRs and two stage revisions and the last of one with primary elective THA (12). The complication rate was similar between the two PJI groups (DAIR: 38%, 2-stage revision: 29%; P=0.2). Similar PJI eradication was seen between both groups also (DAIR: 85% *vs.* 2-stage revision: 89%; P=0.5). Kaplan Meier analysis illustrated similar implant survivorship at 10 years between the DAIR and 2-stage revision groups. When DAIR was successful in eradicating PJI, implant survivorship in those hips with PJI eradication (98%) was akin to that seen with primary THA (98%).

DAIR in revision arthroplasty

Outcome of DAIR is inferior in the revision THA. In the series reported by Tornero *et al.*, revision surgery was an independent predictor of lack of PJI eradication (i.e., failure), with a greater failure rate of 12–22% compared to that seen in primary arthroplasty (23). A DAIR is a suitable option for all different types of revision implants, including megaprostheses. Although surgical options remain the same to other arthroplasties, the morbidity associated with revision procedures is greater and thus a DAIR is an attractive option. Treatment algorithm must be made on an individual basis and account for a number of parameters including concomitant medical conditions, surgical history, PJI history, organism identified, and patient wishes. However, data on outcome in this challenging patient group is limited and of small series (24,25).

Functional outcome following DAIR

Advocates of DAIR would argue that a procedure not disturbing a well fixed prosthesis and any associated interfaces) is likely to be associated with superior outcomes compared with revision surgery (26,27).

We have previously reported on patient reported outcome using the Oxford Hip Score (OHS) post DAIR for a number of patients. Superior OHS was seen in patients who had a DAIR following primary THA (OHS: 39) compared to those having a DAIR following revision surgery (OHS: 26). Better OHS was seen when no complications were sustained post-DAIR (OHS: 39); however outcome was inferior when complications were encountered (OHS: 25).

In order to better determine how functional outcome following DAIR compares to that of an uncomplicated primary total hip arthroplasty and a two-stage revision, a case-control study was performed. Patients that had a DAIR had inferior OHS (38) compared to primary THAs (42) but the OHS was significantly better compared with patients that underwent two-stage revision (31). Two further studies have since reported similar findings (26,28). Patient reported outcome following DAIR (HOOS and HHS/QOL) was like that seen in primary THA, especially if there were no complications related to the DAIR procedures.

Mortality following DAIR

Most studies reporting on mortality rates in PJI don't distinguish between types of treatment, being either DAIR, single-stage or two-stage revision.

A population-based cohort study from the Danish registry, linking to other National databases reported an 8% 1-year mortality rate in patients who underwent revision for PJI; which was significantly greater compared to 5% for the group revised for reasons other than PJI and 2% for the group who had no undergone a revision (29).

We have also previously reported high mortality rate in a hip DAIR cohort of 13% at 5 years post-surgery. Interestingly, this was not dissimilar to the mortality rate of patients with PJI treated with two-stage revision (35%) (12).

Health-care costs associated with DAIR

PJI is associated with a significant additional cost related to the delivery of care. Data from the USA suggest that the overall cost to the American health care system to treat PJI was $566 million in 2009 alone, a number that is

Table 2 McPherson and colleagues staging system for PJI

Category	Grading	Considerations
Infection type	I	Early post-operative infection
	II	Acute haematogenous infection
	III	Late chronic infection
Systemic host	A	No compromise
	B	Compromised (£2 factors)
	C	Significant compromise (>2 factors) or one of the following
		Absolute neutrophil count <1,000/mm^3
		IV drug use
		Dysplasia or neoplasm or immune system
Local factors	1	No compromise
	2	1–2 compromising factors
	3	> 2 compromising factors

Systemic factor: age >80 years, alcoholism, nicotine use, chronic indwelling catheter, malnutrition, diabetes, liver, renal or pulmonary insufficiency; Local factors: acute infection present, multiple incisions, soft tissue loss, subcutaneous abscess, cutaneous fistula, prior articular trauma or fracture. PJI, periprosthetic joint infection.

projected to reach $1.62 billion in 2020 (30). In Europe, the mean cost of a total joint arthroplasty is €7,200 (31). The excess cost is €12,800 for a DAIR and €44,600 for a two-stage revision. Looking at data from the USA (30), a DAIR procedure seems cost efficient as well as having the advantages of better functional outcome and improved quality of life compared to a two-stage revision (12,31).

Two studies have evaluated the health care cost differences between two stage, one stage and DAIR surgical options (32,33). The authors have noted that even though a DAIR approach may, in many cases, require a second surgical procedure, it is far more cost efficient, with less than half the cost of a 2-stage revision.

Factors associated with outcome

Patient-related factors

A number of patient-related factors have been associated with success following PJI. Thus, a host classification system is of significant value in the treatment of PJI. The McPherson Classification system is most commonly used (34) (*Table 2*). A number of studies have highlighted patient-specific factors that are associated with outcome post-DAIR (*Table 1*).

Because the implants are retained, the success of a DAIR is probably dependent on the patient's immune system (15). Compromised host immunity, secondary to conditions such as diabetes, rheumatoid arthritis (RA) or other inflammatory disease has also been reported to lead to inferior outcomes with DAIR. The risk was greatest for late acute PJIs; failure rate was 74% in patients with RA compared to 43% in patients without RA.

McPherson host grade B and C are also associated with increased failure rates following DAIR compared to healthy individuals (35). An ASA grade or 3 or 4 has also been associated with a 7-fold increased in failure rate following DAIR in hip PJI (36). Similarly, obesity (BMI >30) is associated with increased failure rate following DAIR (15). Nicotine has also been associated with up to a 12-fold risk of recurrent PJI (13).

In more recent cohort studies of late acute PJIs, age over 80 has been independently associated with worse outcome. Male sex, chronic renal failure and liver cirrhosis were independent predictors of DAIR failure (37). However, it is important to consider that such factors are associated with inferior chances of successful outcome regardless of treatment modality offered (38-40).

Another major patient related factor is the quality of the soft tissue prior to surgery. Revision surgery may be associated with reduced bone-stock, compromised soft

Table 3 KLIC-score. Preoperative risk score developed to predict failure following DAIR for early acute PJIs

KLIC-score	Parameter	Individual parameter score	Total score	Failure rate (%)
K	Chronic renal failure (kidney)	2	≤2	4–5
L	Liver cirrhosis	1.5	2–3.5	19
I	Index surgery: indication prosthesis: fracture OR revision prosthesis	1.5	4–5	55
C	Cemented prosthesis	2	5.5–7	71
	CRP >115 mg/L	2.5	≥7	100

DAIR, antibiotic-treatment and implant-retention; PJI, periprosthetic joint infection.

Table 4 CRIME80 score. Preoperative risk score developed to predict failure following DAIR for acute hematogenous PJIs

CRIME80 score	Parameter	Point(s) allocated per parameter	Total score	Failure rate (%)
C	COPD	2	–1	22
	CRP >150 mg/L	1		
R	Rheumatoid arthritis	3	0	28
I	Indication prosthesis: fracture	3	1–2	40
M	Male	1	3–4	64
E	Exchange of mobile components	–1	≥5	79
80	Age 80 years	2		

DAIR, antibiotic-treatment and implant-retention; PJI, periprosthetic joint infection.

tissue envelope and greater amount of foreign material which likely contribute to the higher failure rate seen in the setting of revision THA (11,13,41). Lastly, the presence of a sinus tract is indicative of chronic PJI and a risk factor for failure (42-44).

Two scores have been used as prognostic indicators for success following DAIR; the KLIC (*Table 3*) and the CRIME80 (*Table 4*). However, these scores have not to date been validated by other authors.

PJI-related factors

Chronicity of symptoms

DAIR is an urgent; not an emergent procedure. Data have shown that interval between onset of symptoms and operation is an important factor influencing success. Exact cut-off intervals beyond which DAIR should not be attempted has not been determined. Nevertheless, symptoms less than one week were associated with higher chances of success (72.0% versus 51.8%, P<0.0001).

Interval since surgery

Timing is of the essence in treating PJI. Multiple studies have found that DAIR within 6 weeks of index surgery is associated with improved chances of PJI eradication (7). The shorter the interval the better the success, especially if performed within 15 days of implantation (23). In various studies, chronic or late presenting infections appear to do poorly with DAIR and are better treated by revision surgery. However, some studies show an eradication of infection with one or two DAIR up to 85% if the implants are well fixed and the bone-cement interface intact (7,12), even in chronic infection.

The 2018 International Consensus Meeting says that there are no absolute contraindications to perform a DAIR procedure, but a DAIR should be discouraged when the chance of failure without removing the implants is very high (37). It is important to differentiate between chronic infection and acute late haematogenous spread. A careful history, including the index procedure post-operative course (wound healing, prolonged erythema, stiffness) and recent illness (e.g., urinary tract or respiratory infections) should be taken to help establish chronicity.

Causative organism

The causative organism is an important factor contributing to the success or failure of DAIR. Staphylococcus aureus has been associated with higher rates of DAIR failure, with even worse results with methicillin resistant strain (MRSA) (11,13,14,36,42,45-49). In such cases success rate as low as 30% have been reported (36), however the results of MRSA being associated with higher failure rate is not universal (43). A study of a 386 early acute PJIs showed that the percentage of failure was 17% higher when *S. aureus* compared to other micro-organisms was the infective organism (50).

The presence of enterococcus has also been associated with high DAIR failure rate (53%) (18). We have previously noted that infection with *Streptococcus* species was associated with better outcome compared to other organisms (7).

Implant-related factors

DAIR procedures undertaken on primary arthroplasties performed for the treatment of hip fractures have been shown to have a significantly higher rate of failure (20–30% higher), compared to cases that were done for the treatment of primary osteoarthritis (18,50,51). There is little doubt that that the inferior physiological reserve present in the elderly having received a hemiarthroplasty is contributing to the reduced chances of success. However, it is unknown whether the infective organism has also infected and resides in the acetabular surface (cartilage), thus reducing the chances of success without effective debridement and conversion to a total hip arthroplasty; further study is needed to evaluate this.

As aforementioned, revision cases have also been shown to be associated with inferior chances of success compared to primary cases (7).

There are little data regarding type of fixation and chances of success following DAIR. The presence of a cemented prosthesis was associated with inferior chances of success (OR: 8.7) in one study; however, the results of that study remain to be validated by others to date (18).

It is a matter of debate whether in cases with cemented femoral components of collarless, polished, tapered designs with macroscopically sound interfaces, the stem should be removed, and a new stem cemented in place. Although, such procedures would be associated with minimum morbidity, it would be considered as a revision arthroplasty in registry data. Yet, such practice would undoubtedly reduce the biofilm presence and likely improve chances of success.

Surgical-related factors

Arthroscopic treatment

Although data on the use of arthroscopic treatment in PJI primarily stems from the knee literature, there is no doubt that arthroscopic debridement should not be the treatment of choice. This was also recommended by a strong majority in the recent International Consensus Meeting (37).

Exchange of modular parts

Exchange of modular parts is strongly advised as previously highlighted in the systematic review and our data (7,21). Exchanging the modular parts was associated with better chances of success (risk ratio: 3.7) and an improved 10-year implant survival (86% *vs.* 68%).

Drain

Using a drain to decrease dead space and prevent fluid accumulation is also generally well accepted. Drains are usually removed when there is minimal drainage (less than 50 cc/24 h), most often 48–72 h postoperatively (11,52).

Number of liters in wash and type of wash

No studies have reported on the optimum volume or type of fluid to be used. However, most would agree that 6–9 L of irrigation solution should be used. The solution should be either saline or a dilute anti-septic solution, mixed with saline (24).

Local antibiotic delivery

In order to improve/increase the level of antibiotic in the hip, local administration has been considered. Most of literature is focused on the use of catheters and pumps in the knee. However, the results have not shown a significant improvement in success rates (53-56).

There has been recent interest in the use of calcium sulphate beads as carriers for the delivery of local antibiotics. However, their efficacy has not been shown in high level evidence studies. Furthermore, certain complications have been associated with the self-degradation of the beads (i.e., transient hypercalcaemia and heterotopic ossification), which may compromise outcome. Current evidence does not support their routine use (57).

Antibiotic-related factors

Type of antibiotic regimen

Type of antibiotic used should be of course guided by the infection disease specialist taking into account host- and infective-organism characteristics. The use of Rifampicin has improved chances of success with sensitive bacterial species (58,59). Data of prospective cohort studies has shown that the use of fluoroquinolones in PJI's with sensitive gram negative species is protective and associated with lower failure rate (7.1%) compared to other antibiotic regimens (37.5%) (P=0.04) (60).

Duration of treatment

A recent study found that DAIR in hip PJI had an overall success rate of 83% with additional chronic antibiotic suppression for the implant and/or the patient's life (35). Such an approach should be used with caution as chronic antibiotic suppression therapy may lead to other problems, such as antibiotic resistance. Thus, it should be restricted to a minimum number of patients, i.e., those too frail to go through further surgery if deemed necessary.

Most studies use between 3 and 6 months of antibiotic therapy duration. Byren *et al.* showed that prolonging antibiotic treatment only postpones rather than prevents failure (11).

Closing statement

DAIR is a valuable option in the treatment of hip PJI. Singly, and when necessary repeated, DAIR can achieve infection eradication in the majority of cases of patients in the hands of experienced surgeons in specialised centres with a multi-disciplinary team approach. DAIR should always be considered as a treatment option despite interval from index procedure if the bone-implant interfaces are stable. Exchange of modular components and thorough debridement are paramount (12). Prospective studies are sparse and necessary to test the efficacy of the DAIR in an MDT setting.

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