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The profile of Hip and Knee Periprosthetic Joint Infection cases at Dr. Cipto Mangunkusumo Central National Referral Hospital

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ABSTRACT

Background: The most troubling complication of joint replacement procedures is periprosthetic joint infection (PJI). Pathogen identification increases the likelihood of successful treatment. The data of PJI are mostly unpublished in Indonesia. In this study we aimed to investigate the characteristics of PJI of a national hospital in Indonesia.

Material and methods: This research was a cross-sectional study. The inclusion criteria were patients diagnosed with PJI confirmed by examination of fluid exudate culture, sedimentation rate and C-Reactive Protein, which was accompanied by dislocation, fracture and/or loosening of the prosthetic joint and diagnosed between January 2019 to July 2020.

Result: The mean age of patients who underwent revision surgery for PJI was 50.0 ± 14.69 years-old with a slightly higher proportion of men (63.6%). Of the 21 patients, some patients had a history of surgery more than once. The clinical outcome was assessed with the Harris Hip Score (HHS) and the Visual Analog Scale (VAS). The mean HHS of all hip replacement surgeries increased from 61.4 (48.15 to 68) before surgery to 82.5 (75.7 to 84) at the 12-month follow-up post last surgery (p=0.03). Likewise, the VAS value decreased from 3 (2 to 4) before surgery to 2 (1 to 2).

Conclusion: Gram positive bacteria were more prevalent compared to gram negative bacteria. The difference in the microorganism spectrum could be one of several factors. This pattern should be explored in the future by adding more samples to the study. Overall, the clinical outcome was better in both total hip and knee arthroplasty patients, measured by the Harris hip score, visual analog scale, and the knee society score

Keywords: *PJI, TKR, THR, microorganism profile*

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Introductions

Joint replacement procedures can relieve pain, improve motor function and reduce dependence on other people, thereby improving a patient's quality of life. The number of joint replacement procedures is increasing every year. In 2010 in the United States there were reported 332,000 total hip replacement (THR) and 719,000 total knee replacement (TKR) procedures.[1]

As with all medical procedures, joint replacement procedures can result in complications. The most frequent complication that necessitates revision after TKR procedure and is the third cause of revision of THR procedure is periprosthetic joint infection (PJI), which can occur at any time after surgery.[2] PJI occurs in 1% to 2% of first-time arthroplasty and 4% of revision arthroplasty.[2] PJI can be a very serious complication of joint arthroplasty. PJI is associated with significant morbidity, mortality and increased health care costs due to prolonged hospitalization and multiple surgical procedures. [3-4]

Management of PJI requires a complex treatment strategy including the number of revisions to be made and long-term antibiotic treatment. Average cost of PJI care is about 3 to 4 times that of a primary joint replacement, and the average THA revision cost for an ISP is around US$6,000 more than for those associated with TKA.[5] When the causative pathogen is a resistant organism, such as methicillin-resistant *Staphylococcus aureus* (MRSA), the average cost of care for PJIs increases by nearly 60% compared to those caused by PJIs caused by microorganisms that are more susceptible to antibiotic treatment. Pathogen identification increases the likelihood of successful treatment.[1] However, the causative organism is not identified in 10-30% of PJIs.[6]

Today, doctors who provide therapy and diagnose PJI still face serious challenges. Implants as foreign bodies can increase the potential for infection caused by bacteria and the formation of biofilm will make diagnosis and treatment more complex and difficult.[5] Accurate diagnosis by identifying the infecting microorganism must be in accordance with the results of the culture and must be adapted to the right antibiotics administered to overcome the infection that occurs.[8] When the therapy is not appropriate or if the PJI is not diagnosed, this can make the infection resistant and require revision surgery which can cause limb function to deteriorate and result in disabilities, which could ultimately impair a patient's quality of life.[9]

Two-stage revision of prosthesis replacement procedures, involving administration of local and systemic antibiotics, then replanting after eradicating the infection, has become the "gold standard" for management in PJI with a success rate of more than 90%.[10-12] PJI treatment has a high failure rate, which in PJI can eventually lead to arthrodesis, amputation, and even death.[13] Selection of the right antibiotics with wise and rational use combined with adequate surgical procedures are important to avoid antibiotic resistance, so that the infection can be cured and joint function restored without pain.[14]

Material and methods

This research was a cross-sectional study. The selection of subjects was made by looking at the contents of medical records from patients who came to the Integrated Outpatient Clinic and Traumatology Unit, Cipto Mangunkusumo Hospital, Central Jakarta from 2019-2020. Sampling was taken through screening from medical records, adjusted for inclusion and exclusion criteria, using total sampling technique. The inclusion criteria were patients diagnosed with periprosthetic joint infection confirmed by examination of fluid exudate culture, sedimentation rate and C-Reactive Protein (CRP), which was accompanied by dislocation, fracture and/or loosening of the prosthetic joint and diagnosed between January 2019 to July 2020. Patients who had uncontrolled comorbid disease, had a history of autoimmune disease and/or malignancy or were diagnosed as metallosis were excluded from the study.

Data analysis was performed by using the Statistical Program for Social Science SPSS v.25 (IBM Corp, Chicago). Categorical data were presented as sample size (n) and percentage (%). Distribution of numerical data was analyzed by

using Shapiro-Wilk test. Normally distributed data were presented as mean and standard deviation (SD) value, while abnormally distributed data were presented as minimum and maximal value. Paired T-test or Wilcoxon test were used to analyze comparative differences between paired groups. Unpaired T-tests or Mann-Whitney tests were used to compare the means of two groups. Spearman or Pearson correlation was used to see correlation between the variables. A *p*-value ≤ 0.05 was considered as statistically significant. A r value of >0.3 indicated a significant correlation between variables.

Result

This study was conducted on 11 subjects who experienced infection in THR implants. The mean age of patients who underwent revision surgery for PJI was 50.0 ± 14.69 year old with a slightly higher proportion of men (n=7, 63.6%). On the other hand, the mean body mass index (BMI) of these patients was 28.68± 2.11 kg/m^2. Of the 11 patients, some patients had a history of surgery more than once. The surgery referred to here is revision, debridement, or bone spacer installation. The most frequent procedures experienced by patients were four operations, while the lowest was once. The duration between the placement of arthroplasty and the incidence of infection, on average, took about 15.29 months with the fastest infection occurring at 3.7 months after previous surgery and the longest being 60 months or 5 years from the previous operation. Detailed characteristics can be seen in Table I.

Table 1. Subject characteristics

Characteristic	Hip Arthroplasty	Knee Arthroplasty
	N = 11	N = 10
Age	50.0 ±14.69	53.3 ±12.69
Gender		
Male	7 (63.6%)	6 (60%)
Female	4 (36.4%)	4 (40%)
Body Mass Index (BMI)	28.68±2.11	31.07±2.29
Interval between previous surgeries (month)	15.29 (3.7-60)	13.5 (2.5-30)
Number of previous surgeries	1 (1-4)	2 (1-3)
Last operation duration (minute)	206.45 ± 45.64	265.3 ± 84.63
Infection duration (month)	4 (2-24)	5.5 (3-48)
Sinus Tract		
Yes	3 (27.3%)	1 (10%)
No	8 (72.7%)	9 (90%)
CRP(mg/L)	13.1 (3.4-115.8)	5 (1-49.6)
ESR	72.73 ± 31.35	55.6 ± 34.28
Total Leukocytes	9,248 ± 2,227	8,720 ± 2,786

Abbreviations: ESR: Erythrocytes sedimentation rate

At the last operation, the average patient underwent surgery in 206 minutes or about 3 hours 26 minutes, with the longest operation duration of 5 hours. On average, patients visited the doctor for surgery at 4 months after the complaint emerged, with the earliest patient being the second month and the longest being 24 months or 2 years. The majority of patients fall into the chronic PJI category. Of the 11 patients, only 3 (27.3%) patients had sinus tract which was found on physical examination.

In laboratory examinations, the total leukocyte count, CRP and ESR were used for laboratory parameters of PJI. It was found that the mean total leukocyte count in PJI patients of our series was 9,248± 2,227. The mean CRP and ESR in the 11 patients were 13.1 (3.4-115.8) and 72.73 ± 31.35.

In Table 2, there are complete descriptions of the 11 patients enrolled in the study. Only three patients had other comorbidities such as: tuberculosis, SLE, and hypertension. All patients were sampled for culture and evaluation

Table 2. Characteristic of THR patients

Number	Age	Gender	BMI	Comorbid	Number of previous operation	Mean intervals between operation (month)	Duration of last operation (minute)	Onset of infection (month)	Microorganism
Patient 1	42	F	28.00	None	4	15.29	230	4	*S. aureus* (MRSS)
Patient 2	60	M	29.00	None	1	60	205	24	*P. aeruginosa*, *S. aureus*
Patient 3	49	F	26.00	None	1	24	220	2	*S. saprophyticus* (MRSS)
Patient 4	41	M	30.00	Tuberculosis	2	15.5	240	18	*S. aureus*
Patient 5	64	M	32.00	None	1	12	175	3	*S. epidermidis*
Patient 6	48	M	25.00	None	3	7.61	192	9	*P. aeruginosa*
Patient 7	82	M	28.00	Hypertension	1	53	180	9	*S. epidermidis*
Patient 8	33	M	27.50	None	1	34.93	300	3	*Klebsiella pneumoniae*, *Achinobacter* sp.
Patient 9	51	F	28.50	SLE	2	4.56	120	3	*S. aureus*
Patient 10	50	F	30.50	None	2	7.37	184	12	*Klebsiella pneumoniae*
Patient 11	30	M	31.00	None	2	3.7	225	4	*Proteus vulgaris*

Abbreviations: F, female; M, male; SLE, systemic lupus erythematosus

Table 3. Characteristics of TKR patients

Number	Age	Gender	BMI	Comorbid	Number of previous operation	Mean intervals between operation (month)	Duration of last operation (minute)	Onset of infection (month)	Microorganism
Patient 12	42	F	28.00	None	1	3	150	48	*S. aureus*
Patient 13	60	M	29.00		3	30	420	17	Not found
Patient 14	49	M	32.30	None	2	15	240	3	
Patient 15	41	M	30.00	Diabetes	2	8	265	5	*S. aureus*
Patient 16	64	M	32.00	None	2	20	147	6	*S. aureus*
Patient 17	48	M	31.00	None	2	2,5	338	5	*P. aeruginosa*
Patient 18	82	M	28.00	None	1	19	240	18	*S. epidermidis*
Patient 19	55	M	3500	None	1	22	248	11	
Patient 20	42	F	32.40	None	3	8	260	3	*Enterococcus fecalis*
Patient 21	50	F	33.00	None	2	12	345	3	*S. aureus*

Table 4. Operation Type

Operation Type	THR	TKR
	N = 11	N=10
One Stage	6 (54.5%)	10 (100%)
Two Stage	5 (45.5%)	0 (0%)

Surgical interventions for PJI vary and included multiple procedures for infected hip replacements. There were 6 (54.5%) single-stage revision cases, and 5 (45.5%) two-stage revision cases. Details can be seen in Tables 3 and 4.

4.2 Patterns of Microorganisms

In the case of PJIs of all patients, cultures were obtained for all study samples. The cause and duration of infection show wide heterogeneity. Gram positive (53.85%) were found slightly more than gram negative bacteria (46.15%). *Staphylococcus* was the bacteria that causes most hip prosthetic joint infections, followed by *Klebsiella*, *Pseudomonas aeruginosa*, *Achinobacter*, and *Proteus vulgaris*.

Table 5. Patterns of Microorganisms

	THR	TKR
	(n=13)	(n=10)
Total Gram Positive	**7 (53.85%)**	**4 (40%)**
Staphylococcus aureus	4 (30.76%)	3 (30%)
Staphylococcus epidermidis	2 (15.38%)	1 (10%)
Staphylococcus saprophyticus	1 (7.69%)	0 (0%)
Total Gram Negative	**6 (46.15%)**	**0 (0%)**
Acinetobacter baumanii	1 (7.69%)	0 (0%)
Pseudomonas aeruginosa	2 (15.38%)	0 (0%)
Klebsiella pneumoniae	2 (15.38%)	0 (0%)
Proteus vulgaris	1 (7.69%)	0 (0%)
Fungi	**0 (0%)**	**1 (10%)**
Candida tropicalis	0 (0%)	1 (10%)
Organism not found	0 (0%)	3 (30%)

4.3 Clinical Outcomes

The clinical outcomes were assessed with the Harris Hip Score (HHS) and the Visual Analog Scale (VAS). The mean HHS of all hip replacement surgeries increased from 61.4 (48.15 to 68) before surgery to 82.5 (75.7 to 84) at the 12-month follow-up post last surgery (p 0.03). Likewise, the VAS value decreased from 3 (2 to 4) before surgery to 2 (1 to 2) at the last follow-up (p = 0.04). A complete description is shown in Table 5. Statistical tests were done using the Wilcoxon test because the data were paired non-parametric data (Table 6).

Table 6. Outcome of Hip Replacement

	Pre	Post	*p*
Harris Hip Score	61.4 (48.15-68.00)	82.5 (75.70-84.00)	**0.03**[W]
VAS	3 (2-4)	2 (1-2)	**0.04**[W]

WWilcoxon test 1

This study also found a correlation between postoperative HHS with the duration of the last operation (Figure 1). In the correlation between postoperative HHS and operation duration in minutes, the r value was -0.7 with a p value of 0.015.

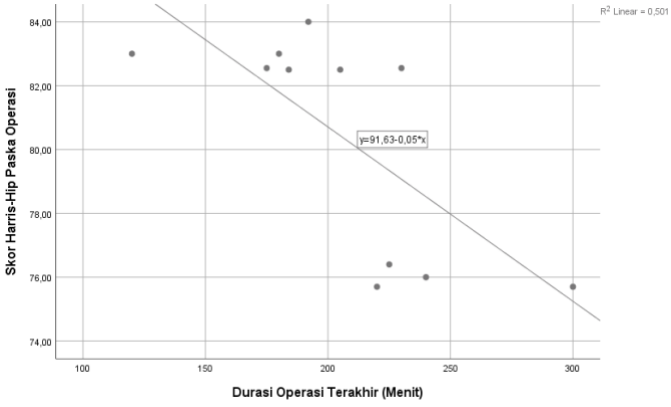

Figure 1. *Scatter Plot depicting the correlation between the postoperative Harris Hip Score and the last surgery duration in minutes.*

Table 7. Clinical outcome of Knee Replacement

	Pre	Post	*p*
Knee Society Score	33.5 (18-52)	68 (57-76)	**0.005**[W]
Knee Society Functional Score	37.5 (15-55)	65 (55-80)	**0.005**[W]
VAS	3 (1-5)	1 (1-2)	**0.006**[W]

[W] *Wilcoxon test; VAS, Visual Analog Score.*

The comparison of the scoring results of the pre and post Knee Society Score (KSS) was statistically significant, with changes from pre TKR 33,5 (18-52) to post TKR 68 (57-76) (p=0.05) as described in Table 7. The functional status of the Knee Society Functional Score also had a similar pattern, namely an increase in lift from pre 37.5 (15-55) to post 65 (55-80) (p=0.05).

Table 8. Relationship Between Knee Replacement and Obesity Output

	Obesity		*p*
	Yes	No	
TKR			
Δ Knee Society Score	33 (21-45)	33 (23-36)	0.819[m]
Δ Knee Society Functional Score	30 (20-40)	30 (20-30)	0.558[m]
Δ VAS	1 (0-4)	3 (2-3)	0.098[m]
THR			
Δ HHS	20.12 (15-26)	21.55 (15-27.55)	0.776[m]
Δ VAS	1 (1-2)	1 (0-2)	0.832[m]

m Mann-Whitney Test; 1

Table 8 displayed the results of tests conducted by assessing KSS in patients who were obese or not, and it was found that there was no significant difference between changes in KSS between obese and non-obese patients (p = 0.819). The same pattern can be seen in the Knee Society Functional Score, where there is no significant difference between obese and non-obese patients (p = 0.558).

4.4 Radiological outcome

Table 9. Postop X-ray description of THR and TKR patients

X-ray description	THR (n=10)	TKR (n=11)
Loosening prosthesis	2 (20%)	1 (9.1%)
Osteopenia	3 (30%)	5 (45.4%)
Soft tissue swelling	5 (50%)	5 (45.4%)
Bone degeneration	4 (40%)	2 (18.2%)
Osteoporosis	1 (10%)	0 (0%)
Periosteal reaction	1 (10%)	1 (9.1%)
Secondary arthritis	0 (0%)	1 (9.1%)
Fracture	0 (0%)	1 (9.1%)
Joint subluxation	0 (0%)	3 (27.2%)

From the post-op x-ray results, 2 cases of THR experienced loosening, while there was 1 case of TKR loosening. For osteopenia there were 3 cases in the THR group and 5 cases in the TKR. Soft tissue swelling was found in 5 cases in THR and 5 cases in TKR as well. Bone degeneration was found in 4 cases in THR and 2 cases in TKR. In the THR case group, 1 case of osteoporosis was found and also 1 case of periosteal reaction. Meanwhile, in the TKR case group, 1 case of periosteal reaction, 1 case of secondary arthritis, 1 case of fracture, and 3 cases of joint subluxation were found. Details can be seen in Table 9.

Discussions

This study was conducted on 11 subjects who experienced infection in THR implants. The mean age of patients who underwent revision surgery for PJI was 50.0 ± 14.69 years with a slightly higher proportion of males (n = 7, 63.6%). The mean BMI of these patients was 28.68 ± 2.11 kg/m^2. Of the 11 patients, some patients had a history of surgery more than once. The surgery referred to here is revision, debridement, or bone spacer installation. In the United States the incidence of PJI is 1.5 to 2.1%.[1] The same pattern was found in this study when comparing the total cases of PJI with all patients who underwent joint replacement. The ratio between men and women in the arthroplasty group was as follows: 7:4 for the THR group and 3:2 for the TKR group. From the published literature there is no specificity in the ratio between men and women to the incidence of PJI.

Of these patients the most surgical history was 4 times and the least was 1 time. The average duration between joint replacement and infection was 15.29 months. The earliest infection occurred at 3.7 months after arthroplasty and the longest was 60 months after surgery.

One of the most dominant symptoms of PJI is pain, so sometimes doctors who treat PJI only focus on how to relieve pain in these patients. In fact, in addition to the pain aspect that must be considered in restoring function, avoiding unnecessary surgery risks, and freedom from antibiotics must also be considered.[3] In this study,

it was found that there was a decrease in VAS from number 3 (2 to 4) in the conditions before surgery, to 2 (1 to 2) after surgery (p = 0.04).

Functional and health-related quality of life reductions are detrimental to patients after infection. Infection has a major impact on physical function and the ability to live independently and carry out activities of daily life. Our work is able to underestimate the severity of the problems faced by contaminated patients in this region, as demonstrated by the significant impact of floors on physical function and positional constraints - the SF-36 functional scale. The complex group reported the lowest possible scores of 18 percent and 58 percent, respectively.[4]

A study by Cahill et al.[4] adds weight to previous studies that have reported poorer functional outcomes due to infection after knee reconstruction and hip arthroplasty. Mental health and social relationships are also affected by infection, although it is not the same as the physical aspect. This influence on social functioning suggests that for this group psychological and social influences are important and contribute to the overall quality of life. The effect of an illness on mental health deserves attention for what is essentially a physical disorder. This effect has not been previously reported, although the interactions between physical and mental health are complex.[4,5]

In patients with infectious complications, overall quality of life is poor. This partly reflects the complexity of this group in the way they handle infection. To reflect the general situation, the complex group was deliberately not focused on one management method. The health status of 12% of patients in the group with complications was rated as equal to or worse than death. This is a substantial proportion due to unresolved active infections either undergoing excision arthroplasty surgery or using long-term antibiotics.[4,6]

Patients whose infections were cured or managed (with the hypothesis preserved) fared better, but were substantially poorer than those in uncomplicated communities. No patient in the uncomplicated category had a health condition worse than death and only one death was comparable. Health status worse than death has been reported previously in patients after major stroke, but not after TJR complications.[4] The first and second stages contain, respectively, acute infection that develops within 6 weeks and prolonged recurrent symptoms. The third stage refers to a prosthetic infection with previously well preserved function and the fourth stage is positive for microbiological isolation during revision of aseptic arthroplasty.[7] A study done by Kim et al.[7] demonstrated that radical debridement with long-term retention of the prosthesis and antibiotics provides a high success rate (up to 100%) in early-onset PJI. The mean Harris Hip Score (HHS) was 91 (82-98) at the last follow-up. Meanwhile, the other group that only used antibiotics did not give as good results as the group combined with surgery. It is recommended that therapy with antibiotics alone is reserved only for patients who are contraindicated for surgery. The same result was found by Fink et al.[8] who performed a similar study to evaluate the outcome of revised patients on PJI. and reported that the total of HHS increased from 45± 20 (pre op) to become 61± 13 using spacers, after the second operation the HHS was increased to 65 point at 12 at 3 months post op, 68 point 14 at 6 months post op, 70±15 at 9 months post, 74± 15 at 18 months post op, and 82± 16 at 24 months post op.[8]

In this study, HHS was used to assess the functional status of postoperative patients. From the correlation studies conducted there was a correlation between postoperative HHS and duration of surgery, which was calculated in minutes with r= 0.7 (p 0.015).

Knee society score (KSS) is one of the scoring systems most often used in cases involving the knee. This system is simple but can objectively assess the functional status of the patient after TKR is performed.[9] In cases with PJI there was a decline in functional status, including those assessed using KSS.[10,11]

One stage exchange (OSE) is a surgical procedure in which an open arthrotomy (open arthrotomy) is performed in one process, accompanied by full removal of the prosthesis and

all previous cement, extensive irrigation and debridement, along with primary implantation of cement containing antibiotics. Arthroplasty is sometimes selected with action against infectious organisms. In the United States, this method is used less frequently. In some conditions, OSE is more effective, especially in cases infected by fungi.[8,12] This is usually only for THR infections. There is also considerable variation in the course of antimicrobial therapy and the duration after OSE. Similar to DAIR, initial antimicrobials for 2 weeks to 6 weeks IV are prescribed for staphylococcal infection which is the most common cause of PJI. Although the IDSA guidelines recommend permanent persistent suppression of such cases, certain variations exist in reality. The success rates of OSE for a documented diagnosis are similar to those for TSE hip and knee arthroplasty infections, whereas OSE is most commonly performed for THR infections.[13,14]

Meanwhile, Two Stage Exchange (TSE) is the most reliable curative therapy method for PJI. This method ends with removing contaminated tissue, scraping old prostheses, debriding, extracting old cement, and inserting antibiotic-filled cement spacers in the joint area in an effort to provide high doses of local antimicrobial therapy and structural support. The cement spacer can be either a static spacer or an articulation spacer to provide continuous mechanical assistance when extracting arthroplasty and provide antimicrobials at high local levels.[15] In the second stage of surgery, another opportunity occurs at the point of the reimplantation procedure to ensure contamination is eradicated by intraoperative co-review; histopathology submitted, including frozen sections, sample selection, and spacer removal; and finally, implantation of a new prosthesis because neither procedure was associated with persistent infection.[13,16,17]

TSE is the ideal method in determining signs of chronic infection, sinus tract involvement, loose prostheses and other cases of multi-drug resistant infection where antimicrobial options are minimal. TSE is provided also for cases of PJI fungus. From many systematic analyzes, the performance rate with TSE is recorded at more than 85%. Factors compatible with TSE failure include sinus tract involvement and a history of previous joint reconstruction, but often the error is simply a recent infection rather than a regression of a recognized organism. There is little evidence that short-term antimicrobial therapy (varying from 28 days to 3 months) in high-risk TSE patients, even with negative reimplantation cultures, can reduce the risk of potential infection, especially in patients with multiple previous revision operations. and ongoing risk factors.[13,18,19]

In deciding whether to choose OSE or TSE, several factors must be considered. Some of them are symptom duration, implant stability, soft tissue and bone condition, presence or absence of systemic symptoms, patient comorbidities, and willingness to undergo several stages of surgery.[3] Several algorithms have been developed to decide the best surgical strategy for the patient.[3,20]

The most common cause of PJI is Gram-negative cocci (approximately 65% of cases) including *Staphylococcus aureus*, *Streptococcus* spp., and *Enterococcus* spp. Another cause is aerobic Gram-negative bacilli (approximately 6% of cases) such as Enterobacteriaceae, Pseudomonas, or anaerobic bacteria (4% of cases) such as Propionibacterium and Peptostreptococcus spp. One fifth or 20% of cases of PJI are polymicrobial. In 7% of cases a negative culture was found and 1% had a fungus.[1,21] Contrary to our study where gram positive bacteria (53.85%) was found slightly more than gram negative bacteria (46.15%). Staphylococcus is the bacteria that causes most hip prosthetic joint infections, followed by *Klebsiella*, *Pseudomonas aeruginosa, Achinobacter*, and *Proteus vulgaris*. Only one fungal infection was found in TKR case (10%), while there was no fungal infection in THR patient.

Apart from clinical features such as acute pain, high fever, looks toxic, secretions in surgical wounds, fistula formation, and purulent appearance, the diagnosis of PJI is confirmed primarily through supporting examinations in the

form of conventional radiology. The most obvious sign that can be seen in PJI is the presence of a thick band (wideband) radiolucent in the region where there is contact between bone and cement or metal which can be accompanied by signs of bone destruction.[22,23]

However, in general it is difficult to compare between septic and aseptic osteolysis from just one x-ray examination, and usually a comparison in the form of a previous radiological examination is required. The striking difference is that in the case of aseptic loosening, there will be a relatively slow progression of changes in bone destruction when compared to septic loosening due to infection which will give a faster and more aggressive appearance of destruction. X-ray examinations should be performed on all patients with suspected PJI.[23] Although it can be used to distinguish between aseptic loosening or septic loosening in patients who have undergone arthroplasty, x-rays are not good enough to detect PJI infections at an early stage.[24] From the post-op x-rays examined in our patients, it was found that 2 cases of THR experienced loosening, while there was 1 case of loosening in the TKR. Meanwhile, for osteopenia, there were 3 cases in the THR group and 5 cases in the TKR. Soft tissue swelling was found in 5 cases in THR and 5 cases also in TKR, and bone degeneration was found in 4 cases in THR and 2 cases in TKR. Furthermore, in the THR case group, 1 case of osteoporosis and 1 case of periosteal reaction was also found. Meanwhile, in the TKR case group, 1 case of periosteal reaction, 1 case of secondary arthritis, 1 case of fracture, and 3 cases of joint subluxation were found

Conclusions

Gram positive bacteria were more prevalent compared to gram negative bacteria. The difference in the microorganism spectrum could be one of several factors. This pattern should be explored in the future by adding more samples to the study. Overall, the clinical outcome was better in both total hip and knee arthroplasty patients, measured by the Harris hip score, visual analog scale, and the knee society score

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