Infection Associated with periprosthetic hip in Vietnamese adults

Abstract

A retrospective case-series study was carried out on 21 patients undergoing postoperative infection following a hip replacement at Vietnam – Germany University Hospital from January 2013 to September 2016. This study were also selected the case for inclusion of the main clinical and paraclinical characteristics of periprosthetic hip joint infection (PJI). The results showed that 47.6% of the cases occurred in the early stage following the Fritzgerald’s classification. Restriction of hip joint movements occurred in 86% of the cases. The incidence of inflammation around the incision was 100% and fistula of hip joint was 95%. The sedimentation rate increased in 100% of the cases, with an average value of 53 ± 26.8 mm. More than a quarter of the patients had positive bacterial culture results, of which almost half were Staphylococcus aureus. The clinical and subclinical characteristics of PJI in this study were quite typical and similar to previous studies. The mainly indexes supporting the diagnosis such as the elevated CRP level, the elevated synovial-fluid leukocyte count, the percentage of neutrophils were consistent with infection and the culture of fluid results. It is very necessary based on the results of bacterial culture tests to be conducted regularly for postoperative follow-up and antibiotics.

Materials and Methods

Subjects: A total of 21 patients diagnosed with periprosthetic hip joint infection and indicated surgical treatment at Vietnam – Germany University Hospital and were diagnosed with periprosthetic hip joint infection following the criteria of Musculoskeletal Infections Society and were indicated surgical treatment [7].

Selection criteria: Selected patients were those who aged over 18, had one or two hip replacements in Vietnamese – Germany University Hospital and were diagnosed with periprosthetic hip joint infection following the criteria of Musculoskeletal Infections Society and were indicated surgical treatment [7].

Exclusion criteria: The patients who were indicated inpatient treatment but did not consent to continue the treatment and could not be contacted after treatment were excluded.

Following the criteria, most of the patients were males (81%) – about four times more than females (19%). The mean age of the patients was 57.4 (range 22–79). Over a half of participants were 55 years and older (66.7%). 71.43% of the conditions in the surgical field are not fully guaranteed, caring for patients after surgery is inadequate, and the habit of using antibiotics treatment without prescription and the high rate of antibiotic resistance are favorable factors for postoperative and recurrent infection.

Background

Periprosthetic hip joint infection (PJI) appears as one of the most serious complications that curbs the success of this measure. Currently, in the United States, PJI rate is 0.88% [1]. The revision surgery treating this complication is predicted to increase significantly in the next 25 years, which leads to an increase in burden for patients, medical staffs and society.

Globally, a range of studies have been conducted to demonstrate the characteristic of PJI, as well as PJI treatment protocols. As hip replacement was applied later in Vietnam than other developed countries, the research about PJI has gradually shown its importance in recent 10 years, when the explosion of the number of hip replacements was witnessed. Nguyen Tien Binh (2004) reported the PJI rate was 6.6% [2], and Do Huu Thang (2004) found at 3% [3]. Tran Dinh Chien and Le Ngoc Hai (2012) assessed the outcome of total hip replacement by the minimally invasive technique with the conclusion that the PJI rate was 1.6% [4]. Among 138 patients undergoing total hip replacement in 108 Military Central Hospital, it’s reported that 5% of them suffered from post-op infection [5]. This figure in Vietnam – Germany University Hospital was 8.6% [6].

Signs and symptoms of infection are generally poor and late-detected. In addition, the difficulty in choosing appropriate treatment and management of PJI is significantly considerable, especially in developing countries as Viet Nam where sterile
patients had not received surgical treatment before admission and 23.81% had surgery for debridement with retention and 4.76% had been treated by implant removal at many different hospitals.

**Study design:** This is a retrospective case-series. Medical records were retrieved from the hospital’s database. In particular, the patients after being diagnosed would undergo surgery to treat the infection. The culture was taken directly in the operation immediately after reopening the incision site, where the Intraoperative periprosthetic tissue was taken, including bone, joint capsule, and soft tissues around the prosthesis. The number of samples taken was at least 3 samples. All of samples were sent to the Laboratory of the Department of Microbiology of Viet Duc University Hospital on the same day for culture, isolation and identification of each bacterium according to standard procedures. These procedures used for culture of periprosthetic tissue is aerobic and anaerobic blood agar, and the duration of incubation is 7 days.

**Study indices:** General characteristics of the participants include age and sex. Classification of the clinical stage according to Fitzgerald (1977) is based on onset time and clinical presentation [8]. There were three stage such as early stage occurs within the first month after surgery and is clearly visible at the extremity with signs such as severe pain, fever, and fistula. Delayed stage occurs from about 1 to 24 months after surgery. Symptoms sometimes manifest solely with pain. Symptoms of joint loosening may or may not be present; and late stage usually develops after 2 or 3 years of hip replacement and is derived from blood and lymph vessels. Postoperative clinical symptoms were evaluated such as pain, restriction of hip joint movements, inflammatory response syndrome (SIRS), and localized localization.

In addition, cases are also evaluated for laboratory tests such as blood culture, culture and identification of bacteria in joint fluid.

**Results**

**General characteristics of the study subjects**

Based on the Fitzgerald’s progressive classification, 10 patients (47.6%) were identified as at the early stage. The number of patients at delayed stage of infection was 7 (33.3%). There were four patients (19%) on the last stage. In the early stage, the onset time might be three days postoperatively, but in the late stage, this might last up to five years.

**Clinical presentation**

Clinical presentation of PJI comprised pain, limitation of hip joint movement, Systemic Inflammatory Response Syndrome and focal inflammation as shown in tables 1–3. 13 patients experienced pain after surgery, accounting for 61.9%. Comparing the level of pain between different stages of PJI, the most severe pain was encountered at the early stage and the least severe pain was witnessed in patients at the delayed stage.

Total 18 of 21 patients (86%) developed movement limitation of prosthetic hip joint after surgery. Of these, 18 of these patients (61.9%) included limitation of movement and pain.

Table 3 illustrates the SIRS occurring in our participants. SIRS, manifested in 66% of the cases, occurs 100% at the early stage, rarely occurs at delayed- and late stage. Research on the traumatic features of hip replacement indicates that fistulas, with different numbers, at different levels and positions, accounted for 95%. These figures are significant at p<0.01.

**Paraclinical characteristics**

To assess the severity of PJI, we included below criteria: ESR and CRP, the culture of joint fluid. The CRP test has only started routinely since 2015. As in our study, we included the small sample size of 21 patients, we did not use this index for the calculation. For blood sedimentation tests (Table 4), the value for the first hour increased in 100% of the cases, ranging from 19 to 140 mm, with an average value of 53 ± 26.8 mm. The highest figure was 61±34.2 mm, spotted in early stage (p<0.05) (Figure 1).

The joint fluid culture showed positive results in 16/21 patients (76.2%), in which 33.3% of the samples were infected with two types of bacteria. The bacteria mostly isolated were Staphylococcus aureus accounting for 42.9% of all cases, and 100% of early stage cases, followed by Gram–negative bacteria (14.3%) with Klebsiella pneumoniae, (7.14%), Escherichia coli.

### Table 1: The proportion of clinical syndromes of hip joint pain according to Fitzgerald’s segment on study group

| Manifestation | No pain | Pain but not significant | Pain, must use painkiller like aspirin | Pain, must use painkiller stronger than aspirin | Pain and restriction of hip joint movements | Total |
|---------------|---------|--------------------------|--------------------------------------|-----------------------------------------------|-----------------------------------------------|-------|
| Stages according to Fitzgerald | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed | Late | Early | Delayed |
| No pain | 1 (10.0) | 6 (65.7) | 1 (25.0) | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 (38.1) |
| Pain but not significant | 1 (10.0) | 1 (14.3) | 0 (0.0) | | | | | | | | | | | | | | | | | | | | | | | | | | 2 (9.5) |
| Pain, must use painkiller like aspirin | 0 (0.0) | 0 (0.0) | 2 (50.0) | | | | | | | | | | | | | | | | | | | | | | | | | | 2 (9.5) |
| Pain, must use painkiller stronger than aspirin | 6 (60.0) | 0 (0.0) | 1 (25.0) | | | | | | | | | | | | | | | | | | | | | | | | | | 7 (33.3) |
| Pain and restriction of hip joint movements | 2 (20.0) | 0 (0.0) | 0 (0.0) | | | | | | | | | | | | | | | | | | | | | | | | | | 2 (9.5) |
| Sum | 10 (100.0) | 7 (100.0) | 4 (100.0) | | | | | | | | | | | | | | | | | | | | | | | | | | 21 (100.0) |

### Table 2: Limitation of hip joint movement.

| Hip mobility | Pain | No pain | Σ No. (%) |
|--------------|------|---------|-----------|
| Limited      | 13 (100.0) | 5 (62.5) | 18 (86.0) |
| Not limited  | 0 (0.0) | 3 (27.5) | 3 (14.0) |
| Sum          | 13 (100.0) | 0 (0.0) | 21 (100.0) |

### Table 3: Rate of Systemic Inflammatory Response Syndrome and Focal inflammation by each stage of Fitzgerald.

| Inflammatory | Stages according to Fitzgerald | Early (n=10) | Delayed (n=7) | Late (n=4) | Σ (N=21) | p-value |
|--------------|-------------------------------|-------------|--------------|-----------|-----------|---------|
| With SIRS    | 0 (0.0) | 5 (71.4) | 2 (60.0) | 7 (33.3) | < 0.01 |
| Without SIRS | 10 (100.0) | 2 (28.6) | 2 (50.0) | 14 (66.7) | |
| With FI      | 0 (0.0) | 6 (85.7) | 1 (14.3) | 10 (47.6) | < 0.01 |
| Without FI   | 10 (100.0) | 1 (14.3) | 0 (0.0) | 11 (52.4) | |

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Table 4: ESR pre-operation.

| Stages      | X ± SD (mm) | p-value |
|-------------|-------------|---------|
| All of stages | 53 ± 26.8   | < 0.05  |
| Early       | 61 ± 34.2   |         |
| Delayed     | 44 ± 16.3   |         |
| Late        | 48 ± 16.5   |         |

(3.57%) and Prevotella denticola (3.57%); Pseudomonas aeruginosa (10.7%); Acinetobacter sp. (7.1%); Gram-positive bacteria such as Enterococcus sp. accounting for 7.1%.

Discussions

General characteristics

Male patients registered the number of 81%. It is significantly higher than the number of female patients (19%). This proportion is similar to the study of Tran Dinh Chien and Le Ngoc Hai (2012) in which the proportion of males and females was 88.7% and 11.3% respectively [4]. This indicates that in Vietnam, male is more likely to have a hip replacement and postoperative complication rather than female. In Vietnam, the male generally does the labor-intensive tasks in order to make a living, therefore, after surgery, they tend to work early than female. In Vietnam, male is more likely to have a hip replacement and postoperative complications compared to female. In the study by K. Liu (2014), the proportion of patients in the delayed and late stages accounted for almost 100% of the cases [10]. This can be explained by the fact that, in Vietnam, preoperative, postoperative and postoperative factors are significantly higher than those in developed countries [10].

Clinical presentation

Of the functional symptoms, pain is considered as one of the most annoying symptoms after surgery that causes patients to have a re-examination. It is reported that pain is also the most common symptom patients experienced after surgery with the proportion of 79% to 100% [11]. In PJI, pain occurs mostly in early stage due to post-op related mechanism, lasting in a certain period. Whereas, pain in patients undergoing antibiotic-loaded cement spacers is more likely from muscle strain, anatomical and physiological incompatibility of temporary joint, presenting by severe pain, continuously and gradually increases [11]. In our study, patients experienced preoperative pain in different levels. Comparing pain levels between stages, the most severe pain was recorded at the early stage and the least severe pain was recorded at delayed stage. As stated by Fitzgerald, pain in the early stage is the most severe. This can be explained by the fact that, in early stage, among the first month postoperatively, local injuries are healing, inflammation reaction is triggered and vigorous in structures surrounding the joint. Naturally, even if patients did not have an infection, they might have pain in different levels when rehabilitation [8].

Another common symptom is restricted range of movement of the hip joint registering 86%. There are two key situations for this. Firstly, it happens immediately after surgery because of bacterial infections, patients cannot or do not dare to continue rehabilitation training. Therefore, ROM as well as the load-bearing capacity after surgery is not ameliorated or even deteriorated comparing with that before surgery. Secondly, after a successful hip replacement, patients do a good rehabilitation, but after a period, due to bacterial infections, the function of the prosthetic joint movement is decreased.

Both the situations require patients to have re-examination and additional treatment. According to Richard Trebce (2012), the infection causes the artificial joint to be gradually loose and painful, even if the loose joint does not appear in all patients [8]. In the delayed stage, the most common manifestation is persistent postoperative pain, and more obvious when the joint works excessively. In some cases, the infection develops later than others, manifested by pain, gradually increasing, with limited range of motion. And at the same time, aside from...
demonstrated that in pain around the incision. At the same time, the development of infection with swelling, heating, redness, and affecting the patient's activity. After the and range of motion of joints are also significantly reduced, leading to a fissure, which is passed outside to skin.

In contrast to figure for fistula, the inflammation around the hip replacement is not the same between the subjects studied. The incidence of local inflammation was 52.4% with swelling, heating, redness, and pain at various degrees. The onset of inflammation occurred mostly in the early stage with 100% of the cases, only one case had inflammation at the time of delayed stage. This significant difference with p <0.01 demonstrated that inflammation around the incision was one of the main symptoms for early diagnosis. In our opinion, in the early stage, the incision process is accompanied by the development of infection with swelling, heating, redness, and pain around the incision. At the same time, the fistula was epithelialization and gradually became chronic. The function and range of motion of joints are also significantly reduced, affecting the patient’s activity. After the fistula is formed, systemic symptoms also decline. In rare cases, septicemia occurs. Patients who have had fistulas usually only tolerate within 1 year except for some cases which the wound heals spontaneously [13].

Paraclinical characteristics

In our database, blood sedimentation tests showed an increase in the first hour in 100% of the cases with an average value of 53 ± 26.8 mm. The highest value was 61±34.2mm, spotted in the early stage (p<0.05). This figure in the study by Aljanipour (2013) was 54.5mm in the early stage and 48.5 in the late stage. The difference between ESR among stages is understood as the pathophysiology of PJI [14]. All the above results illustrate the fact that, along with CRP, ESR is the index of high sensitivity and high specificity that is easy to approach and economical, advantageous to disease diagnosis and follow-up.

Hip joint fluid cultures from all 21 joints were examined by microbial culture, bacterial identification, and antibiogram. Of these, 16 patients were true positive (76.2%), in which 33.3% of the cases were identified as infected with two types of bacteria. This proportion is similar to that in Ekpo study (79%).

According to A. J. Tande and R. Ratel (2014), the false negative results range from 5 – 35% among studies. The author also figured out that there are two main rationales for this situation. Firstly, bad joint aspiration leads to omit some infection or penetrate bacteria from other sources to sample. Especially in the late stage of infection, the infection site is generally located in deep under the skin, along with tissue surrounding the joint and on the artificial joint surface. Secondly, it results from the inaccurate usage of antibiotic protocols. Ideally, antibiotic therapy should be stopped at least 6 weeks preoperatively therefore antibiotic remains inhibiting effect on bacteria causing false negative results [11]. The bacteria that were mostly isolated included Staphylococcus aureus accounting for 44.9%, and 100% of early stage cases, followed by Gram-negative bacteria such as Escherichia coli, Klebsiella pneumoniae, Prevotella denticola at 14.3%, Pseudomonas aeruginosa at 10.7%, Acinetobacter sp at 7.1%, and Gram-positive bacteria such as Enterococcus sp at 7.1%. According to many studies in Vietnam, Staphylococcus aureus is one of the most dangerous bacteria due to their high antibiotic resistance.

Conclusion and Recommendation

Clinical and paraclinical characteristics of prosthetic hip joint infection in Viet Nam in our study are generally similar to previous studies. For instance, fistulas and joint mobility limitation are the two most common symptoms of this type of infection, which accounted for 95% and 86% respectively. In terms of paraclinical characteristics, ESR increased in 100% of the cases and the highest figure was recorded in the early stage of the PJI. Bacterial cultures were positive in 76.2% of the cases.

It is further evidence of the need for surgeons to ensure strict sterilization procedures during surgery. In particular, training should be strengthened in the area of joint surgery in strict compliance with these procedures. In addition, antibiotic prophylaxis should be used prior to hip and postoperative surgery, and close monitoring of bacterial infection, especially bacterial culture.

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