



Research Paper

Megaprosthesis limb salvage surgery: Outcome and challenges in treating advanced bone tumour cases in vast archipelago in Indonesia. A case series

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ABSTRACT

Introduction: Limb salvage is considered as a more popular option in Indonesia, as amputation is considered offensive and taboo for many Indonesian cultures and societies. We evaluated the outcome of a series of LSSs with megaprosthesis and their challenges during treatments in Indonesia as the biggest archipelago nation in the world.

Methods: Thirty-two patients originated from different islands in Indonesia with advanced lower extremity bone tumours were prospectively reviewed. Data was obtained from surgeries, which was conducted between 2011 and 2015 by two orthopaedic oncologist at Cipto Mangunkusumo Hospital. Functional outcome using musculoskeletal tumour society (MSTS) score and oncological outcome were evaluated manually during every outpatient visit at 3, 6, 12 and 24 months.

Results: Eight patients originate from Sumatra, one from Moluccas island, and twenty-three based in the Java island. We documented fourteen osteosarcomas, two cases of metastatic bone disease, fifteen giant cell tumours, and one chondromyxoid fibroma. Compared to preoperative score (mean 5.3, MSTS Score range 0–10), postoperative result (mean 25.2, MSTS Score range 53.3–90) at two year revealed 4.75 fold of improvement. Nearly half of the patient (40.6%) showed excellent score (MSTS Score range 76.6–96.6) after one year. We reported several complications including: infection, knee dislocation, mechanism extensor disturbance, amputation, and nerve injury. Lower MSTS score was correlated with higher serum alkaline phosphatase (SAP) ($p = 0,031$) and increase intraoperative blood loss ($p = 0,033$). Complication was found to be associated with tumours that underwent extensive soft tissue reconstruction procedure ($p = 0,021$).

Conclusion: Functional outcome up to 24 months recorded satisfying result. Several complications occurred during our study also passed struggles for our patients during follow up care due to geographical challenges. Nevertheless, for carefully selected patients in Indonesia, LSS with megaprosthesis is an option that technically visible and culturally acceptable.

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1. Introduction

Bone tumours are uncommon compared to other neoplasm, yet its management has been evolving for the recent decades. World Health Organization (WHO) stated that in 2002 primary malignancy in the bone is only around 0.2% of all tumours in human [1–4].

The concept of limb salvage surgery (LSS) has gradually developed over the last twenty-five years. These advancements in bone

tumour management have given both surgeons and patients more options for treatment, other than mere limb ablation. Currently, 90–95% of patients with sarcoma of the extremities that were administered in tertiary referral centre can undergo musculoskeletal LSS with a successful result. Some previous studies presented benefits and up to 70% of survival rate from limb sparing surgeries using megaprosthesis as option to preserve limb after giant osteosarcoma or Ewing's sarcoma [5–11].

Limb salvage surgery considered as a more popular option in Indonesia, as amputation is considered offensive and taboo for many Indonesian cultures and societies. However, to manage bone tumour cases is far from glamorous orthopaedic surgeries and the availability of limb salvage surgeries with endoprosthesis still cannot positioned the outcome into the same level with primary

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joint arthroplasty. In reality, the difficulties of managing bone tumour cases in Indonesia is stretched near to the limit of the surgeon capacity due to the geographic challenges of archipelago nation. Primitive belief and dependency to traditional bonesetter put additional treatment challenges.

Up until 2011, no limb salvage surgeries using modular megaprosthesis had been done in Indonesia. There was not any industry providing the access and no government support for any hospital. Prior to this, the most common limb salvage option conducted in our centre was en bloc resection, extracorporeal irradiation (ECI), and reimplantation afterwards. In this study, we documented series of limb salvage surgeries with megaprosthesis and their challenges during treatments in Indonesia. This study has been reported in line with the PROCESS criteria [12].

2. Methods

2.1. Registration

This study was registered under researchregistry3726.

2.2. Study design and setting

This case series was taken from retrospective data with a prospective observational follow up until 2017. Data was obtained consecutively from surgeries, which was conducted between 2011 and 2015 in Cipto Mangunkusumo Hospital (CMH) act as single centre, tertiary referral hospital for advanced bone tumour cases. Our centre located in Jakarta, the capital city of Indonesia, and covers cases mostly from the western part of the nation. Two orthopaedic oncologist performed all surgeries. They are competent in the field of orthopaedic oncology, microsurgery and reconstruction for more than 5 years experience in the field.

2.3. Participants

For each patient, we recorded gender, age, presenting symptoms and its duration, tumour size, location, hemoglobin level, serum alkaline phosphatase (SAP), lactate dehydrogenase (LDH), and intraoperative blood loss. We evaluate local recurrence, metastasis, complications, and recorded pre and postoperative scoring using musculoskeletal tumour society (MSTS) functional outcome score. Inclusion criteria for limb salvage surgery were no major neurovascular involvement of the tumour, which evaluated preoperative through MRI, no local infection and adequate soft tissue coverage.

2.4. Pre-intervention considerations

Prior to surgery, MSTS score was taken and patients were encouraged to meet our rehabilitation team to learn about rehabilitation protocol post-intervention. This will encourage earlier discharge and mobilization.

2.5. Follow-up

Post surgical follow up was obtained via the out-patient clinic visits, over the phone calls, and double checked with the data available from our orthopaedic tumour registry. The follow up for the patient was recorded quarterly for up to 24 months. Minimum oncologic follow up is 24 months, but we would like to document each progress three-monthly. Scheduled patients administered at oncology out patient clinic. Data was recorded by orthopaedic trainee and surgeon, included latest laboratory result and active and passive range of motion. There were two orthopaedic oncology surgeons in charge for the study, each scheduled weekly to see the patients.

2.6. Statistics

The data were analyzed using SPSS version 21.0. Data were expressed in median and standard deviation. The relationship between oncological and functional outcome with tumour characteristics, patient characteristics, and complications were analyzed using the Exact-Fischer for proportion, and Mann-Whitney *U* test for numerical data. A *p* value of <0.05 was considered statistically significant.

3. Results

We selected thirty-two cases of different lower extremities bone tumour, in which patient were consented to undergo joint preserving reconstruction with megaprosthesis. The patients originated from different islands in Indonesia with advanced lower extremity bone tumours agreed to join the program. Eight patients originate from Sumatra, one from Moluccas Island, and twenty-three based in the Java Island (Table 1). We documented sixteen benign tumours and sixteen malignant tumours (fourteen osteosarcomas, two cases of metastatic bone disease, fifteen giant cell tumours, and one chondromyxoid fibroma) (Table 2).

MSTS was taken at 3, 6, 12, and 24 months. At the end of follow up period, 92.9% patients were able to walk without aids (Table 3). Compared to preoperative score (mean 5.3, MSTS Score range 0–10), postoperative result (mean 25.2, MSTS Score range 53.3–90) at two year revealed 4.75 fold of improvement. Nearly half of the patient (40.6%) showed excellent score (MSTS Score range 76.6–96.6) after one year. During the first three months, MSTS range from 6.67 to 50 (poor-fair). However, number grew during subsequent months with MSTS range from 40 to 83.3 (fair-excellent) in nine-month follow up, good-excellent (MSTS range from 53.3 to 96.6) at one-year follow up, to excellent at two-year follow up. Additional satisfaction outcome was the improving pain scores by Visual Analog Scale (VAS) for each patient from preoperative to post operative period but statistically was not significant. Functional outcome was found to be associated with SAP ($p = 0,031$) and blood loss ($p = 0,033$) (Tables 4 and 5). Our study shows that higher SAP and more blood loss intra-operative related to lower functional score. Complication was found to be associated with tumours that underwent extensive soft tissue reconstruction procedure ($p = 0,021$) (Table 6).

One case of infection was noted in male patient, who came to our outpatient clinic, presents with 52-cm in diameter proximal tibia giant cell tumour with anterior tibia tubercle wound. Intra-operative wound culture revealed a superficial infection of *Acinetobacter baumannii* and *Klebsiella pneumoniae*, which gave sensitivity toward oral ciprofloxacin. Delayed wound closure was performed with skin grafts at a later stage, ten days after first surgery. Six weeks after the grafting, wound was healed with no discharge, and no skin dehiscence. Infection was precipitate by the poor preoperation skin condition.

One patient with knee dislocation came to our outpatient clinic a week after surgery. She came with knee pain and dislocation was present with audible clunk and increasing pain when she attempted to start a range of motion of knee extension and flexion in sitting position. However, she walked with two axillary crutches regardless the condition. In revision surgery, we performed reconstruction of sartorius muscle and suture the free end over the distal femur region using a nonabsorbable, braided surgical suture composed of ethylene terephthalate (Fig. 1). Postoperative knee brace was applied. Patient encouraged starting knee range of motion after two weeks time with gentle guide from rehabilitation team.

One patient performed a weak active knee extension for one year after surgery. After serial of rehabilitation protocol, active knee extension was acceptable for his daily occupation.

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