



# Are Daily Life Activities of Patients with Proximal Femoral Tumor Resection Prosthesis as Good as those of Patients Undergoing Total Hip Prosthesis for Non-Tumor Causes?

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## Abstract

**Introduction:** The Barthel Index of Activities of Daily Life (ADL) is a scale used to evaluate performance in daily life activities and investigate the reason and resulting relationships in a comprehensive, non-biased manner.

**Aim:** The aim of this study was to compare the daily life activities of patients who underwent proximal femoral tumor resection prosthesis assessed by the Barthel Index with the activities of daily living of patients with a total hip prosthesis performed for non-tumor reasons.

**Materials and methods:** Twenty-eight patients were included in the study. Sixteen patients underwent hip prosthesis for reasons other than tumor (femur proximal avascular necrosis, coxarthrosis, etc.) and 12 underwent wide resection and femur proximal tumor resection prosthesis due to primary malignant bone tumor or metastasis in the proximal femur. The Barthel Index was used to evaluate their life quality at 3 months.

**Results:** A total of 28 patients (mean age  $60.9 \pm 1.4$  yrs, range 19.0-84.0, 17 female and 11 male patients) were included into the study. Mean ADL score was  $84.5 \pm 20.6$  (5-100.0). While only one patient was totally dependent in terms of daily life activities, 8 other patients were totally independent. When the patient groups were categorized by degree of dependency according to the ADL scores, it was found that dependency states of the two surgery groups were similar in distribution ( $p=0.212$ ,  $p=0.703$ , and  $p=1.000$  respectively).

**Conclusion:** Functional recovering levels were good in the patients who underwent a surgery for proximal femoral tumor resection prosthesis; there was no significant difference when we compared the functional level after total hip prosthesis applied for non-tumor reasons.

## Keywords

Barthel index, functional recovery, malignant tumor, metastasis, proximal femur, primary bone sarcoma

## INTRODUCTION

Primary bone sarcomas of the proximal femur are rare.<sup>1</sup>

However, it is a frequent localization in terms of especially metastasis. And metastases around proximal femur occur in 10% of the patients with primary malignant tumor. The

most frequent metastasis to bone stems from breast, kidney, thyroid, prostate cancer or myeloma.<sup>2</sup>

The most important aim of treatment in malignant tumors around proximal femur is to decrease the pain in order to provide a better quality of life to patients. A malignant tumor around proximal femur generally manifests with pain, and patients without proper follow-up present with pathological fractures.<sup>3</sup>

The Barthel Index was introduced by Mahoney and Barthel in 1965 and then it was modified by Shah et al. in 1992.<sup>4</sup> This scale is made up of 10 items as follows: feeding, cleaning, self-care, wearing, bowel control, bladder control, going to toilette, moving from wheelchair to bed, walking or dependency on wheel-chair, motion state, and ascending and descending stairs. The main goal of this scale is to assess the patient ability to perform these activities without physical or verbal help. The scale is graded from 0 to 100, and the higher the score, the more independent the patient is. Scores of 0-20 indicate total dependency, of 21-61 indicate severe dependency, 62-90 - moderate dependency, 91-99 indicates slight dependency, and 100 points correspond to total independence.<sup>4,5</sup>

Surgical resection of metastasis and primary malignant tumors localized around proximal femur are mostly related to bone and soft tissue resection. Modular proximal femoral endoprostheses are usually used in the reconstruction of defects occurring after resection.<sup>6</sup> A study comparing functional results of intramedullary nail and endoprosthetic replacement found that endoprosthesis gives better functional results in the treatment of proximal femur metastases.<sup>7</sup>

In this study we investigated the functional results of patients who received endoprosthetic replacement for tumors around the proximal femur and evaluated these results in a comparison with patients who underwent a total hip replacement.

## MATERIALS AND METHODS

The study included patients who underwent hip arthroplasty (either tumor-related or tumor-unrelated). They were divided into two groups: 16 of these patients received hip prostheses for reasons other than tumor and 12 of them underwent wide resection plus femur proximal tumor resection prosthesis due to primary malignant bone tumor or metastases in the proximal femur.

Radiographs of hips of all patients were evaluated preoperatively. Also, hip MRIs were obtained if needed especially for patients with tumors. ADL were used to evaluate the quality of life at 3 months.

### Statistical analysis

Statistical analysis was performed using the IBM SPSS v. 22.0 software (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as number and percentage, while continuous variables were expressed as mean  $\pm$  standard

deviation (SD) and median (min-max) values. The relevance of continuous variables to normal distribution was evaluated using the visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov and Shapiro-Wilk tests). The chi-square test was used for categorical variables to find if there is a significant difference in the frequency between the groups. The Mann-Whitney U test was used for comparison of abnormally distributed data between the groups. The Wilcoxon test was used to evaluate the changes in pain score before and after treatment. A *p* value of  $<0.05$  was considered statistically significant.

## RESULTS

The study recruited a total of 28 patients with a mean age of  $60.9 \pm 1.4$  yrs (19.0-84.0), 17 of whom were female and 11 were male. Mean ADL score was  $84.5 \pm 20.6$  (5.0-100.0). While only one patient was totally dependent in terms of daily life activities, 8 other patients were totally independent (**Table 1**).

**Table 1.** Baseline characteristics

Parameters (n=28)	
<b>Age, years</b>	
Mean $\pm$ SD	60.9 $\pm$ 1.4
Median(min-max)	63.5 (19.0-84.0)
<b>Sex, n (%)</b>	
Male	11 (39.3)
Female	17 (60.7)
<b>Surgery, n (%)</b>	
Hip prosthesis	16 (57.1)
Tumor resection prosthesis	12 (42.9)
<b>ADL score</b>	
Mean $\pm$ SD	84.5 $\pm$ 20.6
Median(min-max)	92.5 (5.0-100.0)
<b>ADL score, n (%)</b>	
0-20 (Total dependency)	1 (3.6)
21-60 (Severe dependency)	2 (7.1)
61-90 (Moderate dependency)	11 (39.3)
91-99 (Slight dependency)	6 (21.4)
100 (Independence)	8 (28.6)

ADL: Barthel Index of Activities of Daily Living

**Table 2** presents the results of the comparison of some demographic characteristics and ADL scale scores of patients undergoing total hip arthroplasty (for non-tumor reasons) and tumor resection prosthesis. Patients operated for tumors and for reasons other than tumor have all been found to be similar in terms of age and sex distribution ( $p=0.403$ ,  $p=0.705$ , respectively). Median ADL score for the group operated for non-tumor reasons was 95.0 (70.0-100.0), and 82.5 (5.0-100.0) for the tumor group. No significant difference was found. Besides, when the patients were categorized in terms of dependency according to

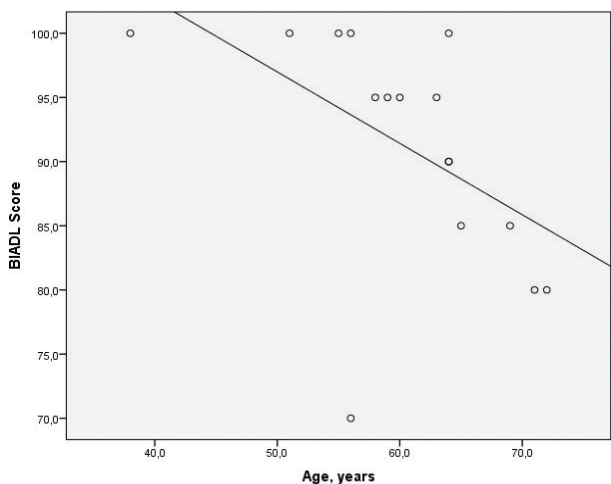
the ADL scores, a similar distribution was found for both groups (respectively  $p=0.212$ ,  $p=0.703$ ,  $p=1.000$ ).

The relation of ADL scores and age values was investigated with Spearman correlation and no significant rela-

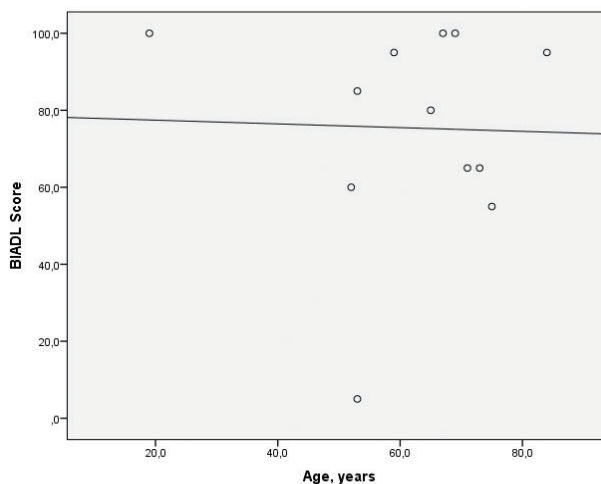
**Table 2.** Evaluation of surgery groups by ADL score

N=28	Surgery		p
	Hip Prosthesis (n=16)	Tumor resection prosthesis (n=12)	
<b>Age, years</b>			
Mean±SD	60.3±8.4	61.7±16.7	0.403 <sup>1</sup>
Median (min-max)	61.5 (38.0-72.0)	66.0 (19.0-84.0)	
<b>Sex, n (%)</b>			
Male	7 (43.8)	4 (33.3)	0.705 <sup>2</sup>
Female	9 (56.2)	8 (66.7)	
<b>ADL score</b>			
Mean±SD	91.3±9.0	75.4±27.8	0.137 <sup>1</sup>
Median (min-max)	95.0 (70.0-100.0)	82.5 (5.0-100.0)	
<b>ADL score, n (%)</b>			
0-60 (Total or severe dependency)	0	3 (25.0)	
61-90 (Moderate dependency)	7 (43.8)	4 (33.3)	0.212 <sup>2</sup>
91-99 (Slight dependency)	4 (25.0)	2 (16.7)	
100 (Independence)	5 (31.2)	3 (25.0)	
<b>ADL score, n (%)</b>			
0-90 (Moderate dependency or above)	7 (43.8)	7 (58.3)	0.703 <sup>2</sup>
≥91 (Slight dependency or Independence)	9 (56.2)	5 (41.7)	
<b>ADL score, n (%)</b>			
0-99 (Dependency)	11 (68.8)	9 (75.0)	1.000 <sup>2</sup>
100 (Independence)	5 (31.2)	3 (25.0)	

ADL: Barthel Index of Activities of Daily Living; <sup>1</sup>: Mann-Whitney U test; <sup>2</sup>: Chi-Square Test



**Figure 1.** Relationship between ADL score and age in non-tumor hip replacement group.



**Figure 2.** Relationship between ADL score and age in tumor resection prosthesis group.

**Table 3.** Correlation between age and ADL score

	ADL score		
	Total (n=28) r(p)	Hip Prosthesis (n=16) r(p)	Tumor resection prosthesis (n=12) r(p)
Age	-0.334(0.083)	-0.676(0.004)	-0.064(0.844)

r: Spearman's correlation coefficient; ADL: Barthel Index of Activities of Daily Living

tion was found ( $r=-0.334$ ,  $p=0.083$ ) (Fig. 1). When separately categorized, it was found that there was no relation in tumor group ( $r=-0.064$ ;  $p=0.844$ ), however there was non-significant strong negative relation in non-tumor group ( $r=-0.676$ ;  $p=0.004$ ) (Table 3). It was observed that ADL scores decreased with the increase of the age of tumor free patients (Fig. 2).

## DISCUSSION

The treatment of patients with malignant tumor in the proximal femur contains choices such as surgery, chemotherapy, radiotherapy and combinations of them. These treatments could be curative or palliative. Which treatment is to be chosen to which patient is planned considering the type of the tumor, stage and the patient factors.<sup>2,3</sup> Radical resection of metastatic tumors gives good results, this protects the patient against local recurrences, cut-outs or the destruction of the implants. The best result is obtained by prosthesis use.<sup>8</sup>

The risks of operation are relatively high due to major weight bearing function of proximal femur. The most important aim of surgical treatment is to alleviate the pain in order to provide the patients with better quality of life.<sup>9</sup> Intra-medullary nailing and proximal femoral endoprosthesis are the two main treatment choices.

Another surgical treatment option in proximal femoral metastasis, especially with pathological fractures, is the intra-medullary nailing. The results of this surgical method are variable. For the patients with good prognosis, complications like nail breakage may be seen or extra operations could be needed.<sup>10</sup> Complications after endoprosthesis are reported to be rare.<sup>11</sup>

Permanent or significant functional loss caused by cancer related problems has increasingly been a source of anxiety since the 1970s. And rehabilitation requirements of cancer patients are accepted by doctors. It is concerning with restoring and keeping the highest functional level, independence, and life quality between cancer patients and the survivals.<sup>12-14</sup>

There are many factors affecting the results of treatment in operations. Cancer patients are at risk of developing various complications stemming from the drug toxicity of chemotherapy, radiation toxicity, primary and/or secondary nerve involvement and long-term immobilization.

Barthel daily living activities index is frequently used in order to determine the functional recovering level of patients for many diseases and procedures including surgical treatments in patients with malignant tumors.<sup>12,15-17</sup> We believe that the Barthel Index is the most comprehensive index among the different functional evaluation scores.

In this study, the functional evaluation with the Barthel Index was performed with patients who received a proximal femoral endoprosthesis due to proximal femoral tumors. At the same time, a comparison was done between the patients with a total hip arthroplasty and those with

similar demographic data. We made sure there was no difference in the age distribution between the two groups by recruiting relatively young patients in the total hip prosthesis group. The functional results were good between the two groups and there was no significant difference in terms of functional results according to Barthel index in the total hip prosthesis patients.

There are only few studies in the literature reporting functional recovery following proximal femoral arthroplasty for tumors affecting the proximal femur. Thambapillay et al.<sup>17</sup> reported in their meta-analysis by which they investigated tumors localized in the proximal femur and underwent arthroplasty that information pertaining to the functional healing condition in 8 of 14 studies. According to these studies, proximal femoral replacement in patients with high grade malignant tumor or metastasis leads to a good functional capacity and a relatively painless extremity. They also reported good or excellent functional results in patients with low grade malignant tumor which were given wide tumor resection.<sup>17</sup> Guzik evaluated the functional results of standard and modular prosthesis treatments with VAS scores and MSTs scores in a study which included 122 proximal femoral metastases. He reported good results after standard and modular proximal femoral endoprosthesis and also that this treatment had been suggested.<sup>8</sup>

There are some limitations of this study. First of all, the study is retrospective and the number of patients is relatively low. Moreover, the daily living activities of patients were analyzed with only one index. Besides, co-morbidities that could affect the results were not investigated. In the future, prospective studies with larger patient samples are needed.

## CONCLUSION

According to the Barthel Index, functional recovery levels are good in patients who underwent proximal femoral tumor resection for implanting prosthesis and there is no significant difference between the functional levels after total hip replacement for non-tumor reasons. Age and sex variables have not been affecting functional healing after proximal femoral tumor prosthesis implementation.

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## Являются ли ежедневная активность пациентов с протезом после резекции опухоли проксимального отдела бедренной кости такой же, как у пациентов с полным протезом бедренной кости по неонкологическим причинам?

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### Резюме

**Введение:** Индекс Бартела для оценки повседневной активности жизни (Activities of Daily Life (ADL)) - это шкала, используемая для оценки совладания с разными видами деятельности в повседневной жизни и всестороннего и непредвзятого изучения причин и связанных с ними отношений.

**Цель:** Целью данного исследования было сравнение повседневной активности пациентов с протезом после резекции опухоли проксимального отдела бедренной кости, оцениваемой по индексу Бартела, с повседневной активностью пациентов с полным протезом бедренной кости по неонкологическим причинам.

**Материалы и методы:** В исследование было включено 28 пациентов. Шестнадцати пациентам была проведена замена тазобедренного сустава по неонкологическим причинам (проксимальный некроз бедренной кости, коксартроз и т. Д.), а 12 – обширная резекция и установка протеза после резекции опухоли бедренной кости вследствие первичной злокачественной опухоли кости или метастаза в проксимальном отделе бедренной кости. Индекс Бартела использовался для оценки качества

жизни пациентов на третьем месяце.

**Результаты:** В исследование было включено 28 пациентов (средний возраст  $60.9 \pm 1.4$  года, возрастной диапазон 19.0–84.0 года, 17 женщин и 11 мужчин). Средний балл ADL составил  $84.5 \pm 20.6$  (5–100.0). В то время как только один пациент зависел от самообслуживания, 8 других пациентов были полностью независимы. Когда группы пациентов были классифицированы в соответствии со степенью зависимости в соответствии с результатами ADL, было обнаружено, что зависимость двух групп оперированных пациентов была схожей по распределению ( $p=0.212$ ,  $p=0.703$  и  $p=1000$  соответственно).

**Заключение:** Функциональные уровни восстановления пациентов были хорошими у тех, кто перенес протезирование после опухоли бедренной кости; не было существенных различий в сравнении функциональных уровней после полного протезирования тазобедренного сустава по неонкологическим причинам.

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### Ключевые слова

индекс Бартела, функциональное восстановление, злокачественные новообразования, метастазирование, проксимальный отдел бедренной кости, первичная саркома кости

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