



Self-related Quality of Life and Functional Results after Internal and External Hemipelvectomy in 82 Musculoskeletal Pelvic Tumours

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Abstract

Background and purpose: Wide resection in pelvis delivers important drawbacks not only physically but also mentally lowering the functional status and self-related quality of life (SRQL) of these patients. Our aim is to show functional results and SRQL in patients with wide resections in pelvis due to musculoskeletal tumours.

Patients and Methods: It is a retrospective study in patients with wide resections in pelvis due to musculoskeletal tumours and we focus on: demographical data, preoperative and pathology studies, type of resection and reconstruction, functional results (MSTS score) and SRQL (SF-12). We have performed 15 external hemipelvectomies (EH), 57 internal hemipelvectomies with pelvic ring stability reconstruction (IHPR), 10 internal hemipelvectomies without reconstruction of the pelvic stability (IHW). There were 10 patients with soft tissue sarcomas and benign but aggressive tumours that we do not include in the study as they did not need hemipelvectomy.

Results: We found there is a tendency to better functional results in IHPR, though it shows no statistical differences between the three types of reconstruction. According to SRQL we observed light score loss in mental status related to general population. On the other hand, physical status showed strong score deviation from general population. Functional results seem to be similar to literature.

Interpretation: The severe loss of function and physical status in these patients underline the type reconstruction and avoiding complications as critical steps. The light score deviation in mental status may represent an adaptive pattern and social support of patients with this severe disease and its complications.

Keywords: Self-related quality of life; Functional results; Pelvic reconstruction and hemipelvectomy

Introduction

WHO defined health some decades ago not only as illness absence but also as complete physical, mental and social welfare. Importance of results that patients feel about self-related quality of life (SRQL) has been growing associated to investigation, clinical practice and health planification. In addition, self-related health status and quality of life could offer complementary information to orthopaedic oncology surgeons for better assessment of the surgical results in our patients. We believe it becomes critical on pelvic musculoskeletal tumours where they get generally great size, affecting the bone and in close relation to critical neurovascular structures for limb sparing. Furthermore, we consider the pelvic bone 'funnel-shaped' structure a key point that originates difficult resections at this level because the inner and deep margins of the tumour are hidden and very tough to dissect.

Additionally, reconstruction is another main step during these patients treatment since daily live activities and work rely on its accomplishment. Therefore, after resection and reconstruction in patients with pelvic musculoskeletal tumours is predicted important drawbacks which will diminish functional results (FR) and SRQL. Thus, the aim of this study is to analyse and compare statistically FR and SRQL in patients who underwent external or internal hemipelvectomy in a single institution as a consequence of musculoskeletal pelvic tumours.

Material and Methods

We retrospectively investigate our database of patients operated because of pelvic musculoskeletal tumours in our institution. We found 107 patients that matched and excluded those ones without hemipelvectomy (benign tumours or soft tissue sarcomas without bone resection). Thereby, we obtained: 15 external hemipelvectomies (EH) with anterior (Figure 1) or posterior flap depending on the situation of the tumor; 57 internal hemipelvectomies (Figure 2) with pelvic ring stability reconstruction (IHPR); and 10 internal hemipelvectomies without reconstruction of the pelvic ring (IHW) which included hip transpositions (Figure 3). Our preferred reconstruction method of pelvic stability was massive allograft, but also saddle and ice-cream cone prosthesis have been used. We collected data from diagnosis, stage, treatment, surgery, follow-up, complications, FR and SRQL. For staging tumours we used the following systems: Enneking for benign [1], MSTS (Musculoskeletal Tumour Society) [1] for bone sarcoma and AJCC (American Joint Cancer Committee) [2] for soft tissue sarcoma. We grouped the patients attending to anatomical region described by Enneking [3], but

Submitted: 13 April 2020 | **Accepted:** 25 April, 2020 | **Published:** 27 April, 2020

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Citation: Israel PM (2020) Self-related Quality of Life and Functional Results after Internal and External Hemipelvectomy in 82 Musculoskeletal Pelvic Tumours. J Surg Oncol Clin Res 3: 5.



Figure 1 Anterior flap hemipelvectomy in 1995 after 5th local recurrence of chondrosarcoma. NED after two more local recurrences.



Figure 2 Desmoplastic fibroma involving zone I+II+III, reconstructed with pelvic massive allograft and internal fixation plus THA, 27 years follow-up.



Figure 3 Osteosarcoma of the left ilium. Extraarticular resection zone I+II+III plus hip transposition and THA. Six years follow-up, NED.

for statistical purposes patients were assigned to three areas of resection which comprise: area I, those involving zone I, I+IV or I+IV+lumbar spine; area II, any region involvement which included zone II; and area III, just zone III.

To measure FR and SRQL we used the MSTs score [4] and SF-12 [5-7] respectively. Both were delivered at time of routine revision or via e-mail survey after telephone communication. MSTs score has been validated within its publication but it has not been translated to Spanish, hence we had to translate

it for patients to fill it keeping the general evaluation (which gets information about residual pain, function and emotional acceptance), together with lower limb questionnaire (that includes three issues, need of supports, walking ability and gait) as they were in the original paper. Furthermore, each parameter is graded from zero to five, for a total of 30 points, and the result is finally showed in percentage. On the other hand, SF-12 test has been translated and validated for general Spanish population. It checks both mental status (MS) and physical status (PS) of the patients through twelve questions obtained by lineal regression from SF-36, which has been widely used for self-evaluation of quality of life. Each of these twelve questions are scored individually. To understand SF-12 results is important to keep in mind that 50 is the mean score and 10 standard deviation (SD) in the general Spanish population with slight variation depending on the age and sex. In this way, minor score differences of 0.2 SD are considered small, up to 0.5 SD are moderate and equal or greater than 0.8 SD are strong.

For the statistical database and investigation we used SPSS[®] 15.0 (RIBM Company) and STATA[®] 14.1 for windows (StataCorp, 2015, StataStatistical Software: Release 14, CollegeStation, Tx: StataCorp LP). This analyses includes descriptive (median, median of censorship and mean plus standard deviation), ANOVA test for association between explanatory variables and MSTs/SF-12 (dependant variables) with significance level $p < 0.05$, as well as Bonferroni correction ($p < 0,015$) for stratified variables with two or more categories.

Finally, the aim of this study was to create a database and to analyse and compare statistically FR and SRQL of patients who went through external or internal hemipelvectomy and its different reconstructions due to musculoskeletal pelvic tumours in a single institution.

This study has been validated by our hospital ethic and investigation comitte.

Results

We obtained 107 patients operated of pelvic musculoskeletal tumours in our institution. The median age is 36, ranging from nine to 78 (8.4% under 16, 9.3% over 65), with 60 men and 47 women. There are 24 benign tumours (eight stage II and 16 stage III), 57 bone sarcoma (two stage IA, 14 stage IB, six stage IIA, 34 stage IIB and one stage III) and 22 soft tissue sarcoma (two stage IB, three stage IIB and 16 stage III and one stage IV). Tumours located as follows: 25 on area I, 71 on area II and 11 on area III. We found 82 out of 107 patients who went through hemipelvectomy. All these cases were allocated to three groups of surgery: 15 EH, 57 IHPR and 10 IHWR. Those ones without hemipelvectomy were excluded as they were not the aim of this study. Median follow-up is 48 months, with median of censorship 74.5 months, ranging from one month to 30 years.

FR and SRQL shown in the study are the ones of those patients who survived and kept on with follow-up. In this way, for FR we evaluated 53 patients (Table 1), 11 of whom were excluded because they did not undertake hemipelvectomy. Mean MSTs of 42 remaining patients according to kind of surgery



Table 1: Statistical MSTS analysis (SD: standard deviation; EH: external hemipelvectomy; IHPR: internal hemipelvectomy with pelvic ring reconstruction; IHWR: internal hemipelvectomy without pelvic ring reconstruction).

	N	MSTS		
		Mean	SD	p value*
Type of surgery				
EH	4	32.5	6.9	-
IHPR	33	61.1	26.8	
IHWR	5	44.0	19.2	
Pelvic zone				
Zone II	28	46.8	25.1	
Zone I	11	78.2	16.9	<0.001 (ref. zone II)
Zone III	3	65.6	16.4	0.552 (ref. zone II)
Reintervention_any cause				
No	11	70.3	26.3	0.039
Yes	31	51.4	24.9	
Infection				
No	29	66.9	22.8	<0.001
Yes	13	32.8	16.9	
General complications related to surgery				
No	18	65.2	27.9	0.05
Yes	24	49.7	23.6	
Total number of interventions				
1	15	67.6	24.8	0.038
2 or more	27	50.1	25.5	

showed that EH was 32.5%, IHPR 61.1% and IHWR 44%, without statistical significance. Tumours affecting zone I had mean MSTS of 78.2 % compare to zone II with mean MSTS of 46.8, $p < 0.001$. Patients reoperated because of any cause had mean MSTS of 51.4%, and those who did not 70.3%, $p = 0.039$. Infected cases showed mean MSTS 32.8% in contrast to 66.9% of those without it, $p < 0.001$. People with general complications derived from surgery had mean MSTS 49.7% contrary to 65.2% of those free of complications, $p = 0.05$. Finally, patients with two or more surgeries obtained mean MSTS of 50.1% in opposition to 67.6% with just one procedure, $p = 0.038$.

According to SRQL statistical analysis, 38 patients with hemipelvectomy remained available for consideration. Accordingly to the kind of surgery, mean physical status (PS) of the five cases with EH was 41.2, 28 with IHPR 39.7 and five with IHWR 40.6, and mean mental status (MS) was 49.6, 40.1 and 44.9, respectively. In addition, based on the pelvic area affected, mean PS in 10 patients of zone I was 37.2, 26 patients of zone II 41 and two patients zone III 40.8, and mean MS was 52.2, 49.3 and 34.9, respectively. No statistical differences were found in these cases.

Complications showed statistical differences in some issues (Table 2). To start with reoperation because of any cause, mean PS was 48.3 of those without it (10 cases) against 37 of the ones with it (28), $p = 0.009$. Moreover, mean PS of 16 cases with just one intervention had 46.4, and 22 cases with two or more was 35.4, $p = 0.004$. Also, 28 cases without infection obtained mean PS 43.8 and 10 cases with it 29.3, $p < 0.001$. None of these situations

showed statistical differences regarding to MS. Additionally, 13 patients who developed adverse events (local recurrence or metastases) exhibited better mean MS with 52.2 compare to 46.9 of those 24 who did not, $p = 0.029$.

Discussion

Pelvic orthopaedic surgery does not have an ideal limb sparing reconstruction method, with advantages and drawbacks basically similar to any of them. The infection is hoped to decrease with the use of silver coated implants, but it has still to be established as standard [8]. The use of pelvic prosthesis is a trend nowadays to improve function, however long term results of these implants are not well known yet [9-12]. Pelvic allografts have been widely used during the 80s and 90s, though great complications have been reported [13-15]. Having all this in mind, the relationships of oncologic ethiology, pelvic reconstruction, complications and FR and SRQL have not been extensively studied in the literature. Refaat et al. [16] compared amputation versus limb-sparing in extremities having similar results in terms of anxiety, drug dependence, sleep problems, depression, limitation of sexual relationships and sport activities, requiring more walking aids those with amputation. Beck et al. [17] reviewed FR and SRQL after internal or external hemipelvectomy and observed that patients were less independent in bladder function with greater pain severity at follow-up compared in those with external hemipelvectomy but overall quality-of-life factors were similar between both groups. Hoffmann et al. [18] evaluated different reconstructions after acetabular involvement advocating hip transposition as the optimal technique concerning the low rate of complications and good functional and quality of life results.

In our study, regarding the dependent variable FR, there's no statistical difference according to the type of surgery, but a slight tendency to better results in those with IHPR. We also have observed poorer results in two situations: patients with complications such as reintervention, infection, general complications related to surgery, those who had two or more surgeries, and with involvement of zone 2 of the pelvis.

Conversely, the dependent variable SRQL shows severe deviation regarding general population in all PS surgical groups without differences between them, with statistically better mean in PS of those patients without complications (reintervention, infection, and the ones who had two or more surgeries). In contrast, MS shows none or light deviation in all the situations, surgery and complications, apart from those patients with adverse events (metastases or local recurrence) who had better results than the ones without them and being statistically significant. This fact looks peculiar, and we think that patients who did not suffer them might have higher expectations of health in the long term and also some social and family limitations because of the impairment of different surgeries and treatment they went through. Recently, Taylor et al. [19] observed this situation with sarcoma survivors where difficulties of mobility and self-image lead to evasive behaviour isolation. Sachsenmaier et al. [20] identified factors that influence unfavourably in mental status on elderly people, without work or that live alone. On the other hand, patients with adverse events obtained better mental



Table 2: Statistical SF-12 analysis. (SD: standard deviation; MS: mental status; PS: physical status).

	N	SF12 PS			SF12 MS		
		Mean	SD	p-value	Mean	SD	p-value
Reoperation_any cause							
No	10	48.3	5.6	0.009	46.9	12.6	0.479
Yes	28	37	12.4		50.2	12.4	
Reoperation_reconstruction failed							
No	31	41.1	12	0.268	48.75	12.5	0.556
Yes	7	35.4	12.3		51.84	12.2	
Total number of interventions							
1	16	46.4	3.6	0.004	47.2	14.6	0.380
2 or more	22	35.4	12.1		50.8	10.4	
Infection							
No	28	43.8	10.5	0.001	50.9	13.1	0.170
Yes	10	29.3	9.7		44.7	8.9	
Adverse event							
No	24	39.7	12.3	0.320	46.9	12.9	0.029
Yes	13	39.1	11.3		52.2	7.8	

status because they may be able to establish different mechanisms of mental status, younger with better function and social and familiar supports [20].

There are some limitations to this study. It is a retrospective one based on historical case series of pelvic musculoskeletal tumours, that is, very uncommon pathology and difficult anatomical region. In addition, this work includes different entities, affecting diverse areas of the pelvis, mixing reconstruction methods. On the other hand, results showed in this report include long term and consistent follow-up of patients analysed.

In conclusion, complications are an unsolved problem, inherent to these entities, location and surgery. Results of any technique are difficult to be reproduced according to data of different studies. From our point of view based on our data and experience, we recommend reconstruction of pelvic stability whenever is possible having in mind that hip transposition is useful technique in certain situations. Future prosthetic designs as well as silver coated implants aim to avoid complications after pelvic surgery. We believe that information and support of these patients is basic, mainly in long term survivors.

Conflict of Interest Statement

There have not been any financial or personal relationships with other people or organisations that could inappropriately influence this work. In the same way, we have not received any funds for this paper.

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