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1 What is the interest of PMR after massive surgery for lower-limb sarcoma?

2
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18 Key-words: bone tumor; joint prosthesis; rehabilitation; autonomy

19
20 **Dear Editor.** We report a series of 10 patients hospitalized in the locomotor physical
21 medicine and rehabilitation (PMR) department of a university hospital after massive surgery
22 for lower-limb sarcoma. For this work, we followed CARE case report guidelines.

23 Sarcomas represent a rare type of cancer, about 0.2% of all cancers[1]. The most frequent
24 location is the femur in 42% of cases, the pelvic location representing only 8% of cases [2].
25 Salvage of the concerned lower limb is always preferred when possible because it does not
26 modify the risk of local recurrence or survival rate as compared with amputation [3,4].

27 Surgery is often responsible for substantial anatomical sacrifices due to the resection of bone,
28 articular and contiguous soft tissues [5]. Pelvic sarcomas are responsible for more morbidity
29 than are distal femoral tumors [6,7]. The consequences in terms of locomotor deficiencies are
30 often at the origin of loss of autonomy. Early care in PMR is recommended to favour
31 functional prognosis [8,9].

32 We evaluated 8 men and 2 women (mean [SD] age 53.6 years [18.4], range 20-76)
33 who underwent PMR after surgery for lower-limb sarcoma from December 2011 to March
34 2016. The sarcoma characteristics are presented in Table 1. The initial surgical treatment had
35 always been a tumor monobloc excision responsible for substantial anatomical sacrifices
36 (Table 1, Figs. 1 and 2). Mean (SD) duration in the surgery department was 19.5 (12.5) days
37 [range 8-46]. With pelvic sarcoma, an initial phase of immobilization with a hip brace was
38 needed at the beginning of the PMR care. Also, one patient who had undergone distal femur
39 surgery required a knee extension brace. The braces were made to measure and unarticulated.
40 Immobilization with a hip brace was 45 days with hemi-pelvectomy type I-II, 30 days with
41 type II and 15 days with type I. The braces were prescribed immediately after surgery. For
42 patients who required bed rest periods (2 patients because of the initial fragility of the scar),
43 PMR care consisted of one session of physiotherapy with joint mobilizations and muscular
44 maintenance. After the potential bed rest period, patients performed 2 sessions a day, 5 days a
45 week. The morning sessions were dedicated to neuro-functional analytic work adapted to
46 deficiencies (range of motion gain, motor control of the hip or the knee); in the afternoon, a
47 more global work was proposed with physiotherapists or occupational therapists and aimed at
48 improving moving and walking abilities (transfers, weight bearing, balance and walking). A
49 1-hour wheelchair practice session per day was systematically proposed to permit wheelchair

50 autonomy. Sport practice was also proposed, initially in wheelchairs and then with weight-
51 bearing exercises according to patients' abilities.

52 Six patients had isolated or associated complications (Table 1). The most frequent
53 complication was infection on the operative site. In the 5 cases of infection, a new surgical
54 procedure was performed. In these cases, the operated site was washed during, sometimes
55 with the prosthetic replacement. Multiple antibiotic therapy was always prescribed. Two
56 infections were associated with hip prosthesis luxation.

57 At the end of the hospitalization, 8 of 10 patients were able to go home: one had to live with
58 his parents and one went to a care home for disabled adults (Table 2). Nevertheless, 3 patients
59 needed help with showering and dressing at home, 2 patients needed the help of a
60 housekeeper and 1 patient needed to have his meals delivered at home as well as help with
61 showering and dressing and the help of a housekeeper because he had a hemi-pelvectomy
62 with sacral fixation of the hip mega-prosthesis (Fig. 2). Eight of 10 patients were able to walk
63 at the end of the therapy but had to use walking aids (Table 2); 4 had to use wheelchairs when
64 going long distances. The 2 patients unable to walk had a pelvic sarcoma with major
65 anatomical sacrifices. All patients were autonomous with their wheelchairs and the 7
66 youngest ones were able to step onto and off a sidewalk. Overall, the mean (SD) Barthel
67 index measuring performance in activities of daily living was 22.5 (6) [range 20-40] at the
68 beginning of the PMR care and 70.5 (13) [50-90] at the end. The mean (SD) stay in the PMR
69 department was 85.8 (34) days [8-46] and the total mean (SD) stay at the hospital was 105.3
70 (39.6) days [49-184].

71 The challenges in the management of pelvic and femoral sarcomas are to increase the
72 survival rate and to preserve function and quality of life [10]. PMR goals are restoration of the
73 previous functional level and independence or to compensate independence loss to maintain
74 quality of life [7]. These challenges and aims are usually studied with a follow-up of several
75 months or years after treatment, so determining the contribution of early PMR care in the
76 immediate aftermath of the surgical management is difficult.

77 PMR care presents several overall benefits for patients with cancers, particularly concerning
78 the improvement of psychological health and pain management (neuropathic and/or
79 nociceptive pain), which are unique to these patients [11]. Rehabilitation programs provided
80 during PMR care could have a decisive impact on the ability to return to work [12].
81 Eight of our 10 patients were able to walk and return home after PMR despite major
82 complications. Technical walking aids were always necessary, but for all patients, including
83 the most dependent ones, wheelchairs always gave them autonomy of movement. In terms of
84 function, surgery for pelvis and femoral sarcoma affects patients' autonomy owing to
85 anatomical sacrifices. The worst results are at the pelvic level because of substantial
86 anatomical sacrifices, which depend on tumor location and local invasion [7].

87 PMR care must be individualized because deficiencies secondary to the surgery vary widely
88 among patients [8,9,13]. An articular immobilization by hip brace is usually necessary with a
89 pelvic or proximal femur lesion because of the lack of hip articular stability [7]. The duration
90 of wearing these splints is empirical; they are rarely maintained for more than 6 weeks and
91 can be removed as soon as articular motor control is restored.

92 At the hip level, function usually decreases because of the loss of articular mobility and
93 adductor weakness [10,14]. Modifications of the hip's center of rotation after megaprosthesis
94 explain these deficiencies [15].

95 Numerous complications are associated with surgery, especially infection on the operative
96 site, which usually requires a new surgical intervention. Many complications occur in the
97 same patient [15]. Infection occurs in 17% to 60% of cases and may have several causes, such
98 as surgery duration, blood loss, vacuity caused by the tumor resection and the use of neo-
99 adjuvant treatments [15].

100 In terms of autonomy, for 8 of 10 patients, the Barthel index increased during the
 101 hospitalization to reach independency (score ≥ 60) after a mean stay of 85.8 days in the PMR
 102 department. For patients with pelvectomy, Beck et al. reported an increase in score from 10
 103 before surgery to 40 at hospital discharge and then 90 after a 6-year follow-up [6].
 104 Nevertheless, only 50% to 70% of the patients were independent and had a mean maximal
 105 walking distance of 45 m. The duration of hospital stay in PMR is explained by the period
 106 required to obtain functional independency permitting a return home or a move to an
 107 appropriate living place. The duration is also increased because of the complications. For
 108 ethical reasons due to patients' severe clinical condition and the potential risks after surgery,
 109 comparison with another comparable group was not possible because of different PMR
 110 management (external care). Because of the complexity and specificity of the management of
 111 sarcoma — short- and medium-term complications such as infections, persistent deficiencies
 112 and long-term oncological follow-up — specific network organizations with surgeons,
 113 oncologists and PMR physicians seem necessary [11].
 114 This series of patients with pelvic or femoral bone sarcomas presented good functional results
 115 after PMR care, allowing for a return home for most, despite the severity of the tumor, and a
 116 60% rate of serious complications. Sarcomas in pelvic and proximal femoral locations were
 117 responsible for more loss of autonomy than were those in distal femoral locations.
 118

119 **Figure legends**

120 **Figure 1.** Total hip megaprosthesis for leiomyosarcoma grade III.

121 **Figure 2.** Hip megaprosthesis with acetabulum fixation on L5-S1 for chondrosarcoma grade
 122 1.

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167 **Table 1. Characteristics of sarcomas, treatments and complications in patients with lower-**
 168 **limb sarcoma.**

<u>Patient no.</u>	<u>Sex Age (years)</u>	<u>Histology</u>	<u>Location (resection)</u>	<u>Surgery</u>	<u>Neo-adjutant treatment</u>	<u>Anatomical sacrifice</u>	<u>Complications (delay from surgery, days)</u>	<u>Admission in PMR after surgery (days)</u>
<u>1</u>	<u>Female 76</u>	<u>Chondrosarcoma grade III</u>	<u>Pelvis (R0)</u>	<u>Pelvectomy I-II Mega-THA</u>	<u>0</u>	<u>Femoral n. Iliopsoas m., Gluteus minimus m.</u>	<u>0 (0)</u>	<u>16</u>
<u>2</u>	<u>Male 56</u>	<u>Chondrosarcoma grade I</u>	<u>Pelvis (R0)</u>	<u>Pelvectomy I-II Mega-THA</u>	<u>0</u>	<u>Gluteal superior and inferior n.; Femoral n.</u>	<u>0 (0)</u>	<u>10</u>
<u>3</u>	<u>Male 65</u>	<u>Chondrosarcoma grade III</u>	<u>DF (R0)</u>	<u>Allo and auto graft synthesis</u>	<u>CT</u>	<u>Fibularis communis n.</u>	<u>Fibular palsy (0), phlebitis (11)</u>	<u>9</u>
<u>4</u>	<u>Male 59</u>	<u>Chondrosarcoma grade I</u>	<u>Pelvis (R1)</u>	<u>Pelvectomy I-II Mega-THA L5-S1 Arthrodesis</u>	<u>0</u>	<u>Pelvitrochanteric m.</u>	<u>Infection (21), THA Luxation (21)</u>	<u>16</u>
<u>5</u>	<u>Male 49</u>	<u>Chondrosarcoma grade III</u>	<u>Pelvis (R1)</u>	<u>Pelvectomy II Mega-THA</u>	<u>0</u>	<u>Pelvitrochanteric m.</u>	<u>Infection (12) THA Luxation (12)</u>	<u>20</u>
<u>6</u>	<u>Male 45</u>	<u>Chondroblastic osteosarcoma</u>	<u>PF (R1)</u>	<u>Mega-THA</u>	<u>CT</u>	<u>Gluteus maximus m.</u>	<u>0 (0)</u>	<u>8</u>
<u>7</u>	<u>Male 20</u>	<u>Leiomyosarcoma grade III</u>	<u>Pelvis (R1)</u>	<u>Pelvectomy II Mega-THA</u>	<u>RT CT</u>	<u>Pelvitrochanteric m.</u>	<u>0 (0)</u>	<u>10</u>
<u>8</u>	<u>Male 65</u>	<u>Osteosarcoma grade I</u>	<u>DF (R1)</u>	<u>Mega-TKA</u>	<u>0</u>	<u>Fibularis communis n., Quadriceps m.</u>	<u>Infection (40), Fibular palsy (0), Acute compartment syndrome (1)</u>	<u>30</u>
<u>9</u>	<u>Female 75</u>	<u>Myxofibrosarcoma grade III</u>	<u>PF (R0)</u>	<u>PTH massive</u>	<u>RT</u>	<u>Pelvitrochanteric m.</u>	<u>Infection (15), Phlebitis (22)</u>	<u>46</u>
<u>10</u>	<u>Male 29</u>	<u>Fusiform and epithelioid cells sarcoma</u>	<u>Pelvis and spine (R1)</u>	<u>Pelvectomy I L2-S1 Arthrodesis</u>	<u>CT</u>	<u>L2-L4 r. Iliopsoas m.</u>	<u>Infection (10)</u>	<u>30</u>

169 DF, distal femur; PF, proximal femur; Pelvectomy I (ilium); Pelvectomy II (acetabulum); Pelvectomy
 170 I-II (ilium + acetabulum); TKA, total knee arthroplasty; THA, total hip arthroplasty; CT,
 171 chemotherapy; RT, radiotherapy; m., muscle; n., nerve; r., roots.
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174**Table 2.** Details on the management and future of patients.

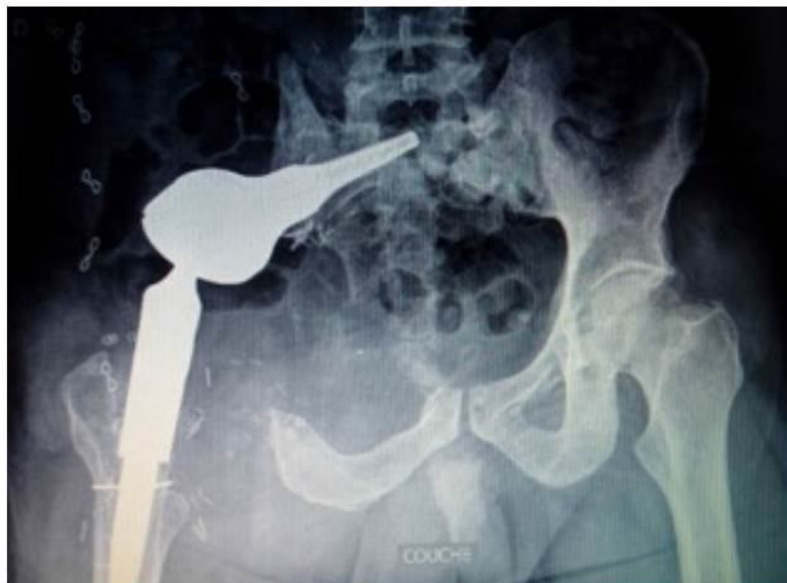
<u>Patient no.</u>	<u>Sex Age (years)</u>	<u>Bed rest period (days)</u>	<u>Joint immobilization after surgery (days)</u>	<u>PMR hospitalization duration (days)</u>	<u>Total hospitalization duration (days)</u>	<u>Return home</u>	<u>Aids</u>	<u>MWD</u>	<u>Barthel index Initial / Final</u>
<u>1</u>	<u>Female 76</u>	<u>0</u>	<u>45</u>	<u>168</u>	<u>184</u>	<u>No (care home for disabled person)</u>	<u>Wh</u>	<u>MW 0</u>	<u>20 / 50</u>
<u>2</u>	<u>Male 56</u>	<u>0</u>	<u>45</u>	<u>39</u>	<u>49</u>	<u>Yes</u>	<u>2 Cr</u>	<u>MW 2</u>	<u>40 / 70</u>
<u>3</u>	<u>Male 65</u>	<u>0</u>	<u>0</u>	<u>62</u>	<u>71</u>	<u>Yes</u>	<u>1 Cr + ankle foot orthosis</u>	<u>MW 3</u>	<u>20 / 85</u>
<u>4</u>	<u>Male 59</u>	<u>21</u>	<u>45</u>	<u>75</u>	<u>91</u>	<u>Yes</u>	<u>2 Cr</u>	<u>MW 2</u>	<u>20 / 70</u>
<u>5</u>	<u>Male 49</u>	<u>0</u>	<u>30</u>	<u>77</u>	<u>97</u>	<u>Yes</u>	<u>2 Cr</u>	<u>MW 3</u>	<u>20 / 90</u>
<u>6</u>	<u>Male 45</u>	<u>0</u>	<u>15</u>	<u>70</u>	<u>78</u>	<u>Yes</u>	<u>2 Cr</u>	<u>MW 1</u>	<u>25 / 65</u>
<u>7</u>	<u>Male 20</u>	<u>0</u>	<u>30</u>	<u>94</u>	<u>104</u>	<u>Yes</u>	<u>2 Cr</u>	<u>MW 3</u>	<u>20 / 85</u>
<u>8</u>	<u>Male 65</u>	<u>45</u>	<u>21</u>	<u>69</u>	<u>99</u>	<u>Yes</u>	<u>2 Cr + ankle foot orthosis</u>	<u>MW 2</u>	<u>20 / 70</u>
<u>9</u>	<u>Female 75</u>	<u>0</u>	<u>45</u>	<u>101</u>	<u>147</u>	<u>Yes</u>	<u>walker</u>	<u>MW 1</u>	<u>20 / 65</u>
<u>10</u>	<u>Male 29</u>	<u>0</u>	<u>15</u>	<u>103</u>	<u>133</u>	<u>No (parents' home)</u>	<u>Wh</u>	<u>MW 0</u>	<u>20 / 55</u>

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PMR, physical medicine and rehabilitation; Wh, wheelchair; Cr, crutch(es); MWD, maximal walking distance; MW 0, transfers autonomous; MW 1, maximal walking distance > 50 m; MW 2 maximal walking distance > 300 m; MW 3, maximal walking distance > 1000 m.



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