

The LUMiC prosthesis for pelvic reconstruction after periacetabular tumor resection: clinical results from a European collaborative study

Number 11460

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Background

Surgical treatment of periacetabular malignancies ranks among the most challenging procedures in orthopaedic oncology. Part of the difficulties result from the complexity of tumor resection; however, reconstructive techniques are also associated with dissatisfying complication rates. In an attempt to reduce complication rates of pelvic reconstruction, we introduced a novel modular implant: the LUMiC[®] prosthesis (implantcast, Buxtehude, Germany).

Questions/Purposes

We initiated a multicenter study with the purpose to evaluate the early- to mid-term clinical results of reconstructing a pelvic defect with the LUMiC[®] following internal hemipelvectomy for a tumor involving the periacetabulum.

Patients and Methods

All consecutive patients who underwent periacetabular tumor resection and subsequent reconstruction with the LUMiC[®] from 2008 onwards were retrospectively evaluated, in eight centers of musculoskeletal oncology. Sixty-eight LUMiC[®] reconstructions were assessed; 18 were subsequently excluded (12 because they had <12 months of follow-up, six because the stem was inserted in the sacrum following resection of the medial ilium). This left a total of 50 patients (26 males, 52%) with a median age of 58 years (12-78) at the time of surgery available for analysis. Uncemented press-fit fixation was the preferred method of fixation (n=45, 90%). Silver-coated cups were used in 30 reconstructions (60%); 27 patients (54%) had dual-mobility articulation. Trevira tubes were used in 15 reconstructions (30%). Chondrosarcoma was the predominant indication for surgery (n=22, 46%); eight patients (16%) had osseous metastases of distant carcinoma, four (8%) had a multiple myeloma. Ten patients (20%) had surgery prior to the LUMiC[®] reconstruction, including three pedestal cup reconstructions (6%; all had failed due to infection) and one massive allograft reconstruction (failed due to resorption of the graft). The resections were type 2 in 23 patients (46%) and type 2-3 in 27 (54%); 21 (42%) had an extra-articular resection. Complications and failures were classified according to Henderson *et al.* Kaplan-Meier curves were used to estimate implant survival rates.

Results

At review, 39 patients were alive (78%; eight with disease) with a mean follow-up of 32 months (12-80). Eleven patients had died (22%; six of disease) after a mean of 16 months (2-51). During follow-up, seven patients (14%) experienced a single dislocation and four (8%) had recurrent dislocations. All but one experienced their first dislocation within one month after surgery. In two patients with recurrent dislocations, the cup was revised to a dual-mobility cup, after which no further dislocations occurred. Of 27 patients with primary dual-mobility cups, two (7%) had a single dislocation; none experienced recurrent dislocations. Therefore, the risk of dislocation was significantly lower for dual-mobility cups (OR 0.1, 95%CI 0.0-0.7, $p=0.01$). Although not significant, the risk of dislocation was lower in reconstructions with a trevira tube (2/15, 13%) than in those without (9/34, 26%). Aseptic loosening occurred in two reconstructions (4%); in one case (after 57 months) after uncemented fixation in a previously failed structural pelvic allograft, and in one case (after 36 months) due to poor initial fixation because of an intraoperative fracture. Both were revised to cemented stems, after which no further complications occurred. Structural complications of the implant did not occur. Three patients (6%) had periprosthetic crack fractures during implantation of the stem. Infections occurred in 14 reconstructions (28%), necessitating removal of the implant in five (10%; four within two months and one low-grade infection after 34 months, after an infected pedestal cup reconstruction). Mean blood loss was 4181mL for patients with an infection, compared with 1653mL for those without ($p=0.003$); mean surgical duration was 7.3 hours for patients with, and 5.2 hours for patients without an infection ($p=0.02$). Local recurrences were diagnosed in six patients (12%). Overall implant survival rates were 92% at two, 86% at four, and 72% at five years, respectively.

Conclusions

Dislocation was the most frequent mechanical complication; however, all were adequately managed with closed reduction or cup revision. Dual-mobility articulation significantly reduces the risk of dislocation and our advice is to use it after any internal hemipelvectomy. We were unable to demonstrate a significant influence of trevira tubes. Both cases of implant loosening resulted from poor primary fixation. Therefore, in case of insufficient bone stock or the inability to obtain stable primary fixation, cemented fixation should be performed. Infection remains of major concern after periacetabular tumor resection. Nevertheless, most infected implants could be retained. It appears that the duration of surgery and, consequently, blood loss are important factors for the risk of infection. When combined with the dual-mobility cup, we consider the LUMiC® a reliable and stable prosthesis for reconstruction after periacetabular tumor resection.