

10729- The use of rapid prototyping pelvic custom made prosthesis associated to bone cutting jigs in pelvic tumor resection.

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Introduction:

The reconstruction of large pelvic bone defect including the hip joint is a difficult procedure associated to long operation time and high numbers of early and late complications. Accurate planning in resection is important to achieve clear surgical margins, and shorten the time whatever the type of reconstruction.

Most of the methods of reconstruction including modular prosthesis and APC (allograft prosthetic composite) are time consuming leading to high level of blood loss during surgery and increasing risk of deep infection.

Recently the use of additive 3D printing has been developed to achieve custom based segment of bone (trabecular titanium). This technique allow to make and accurate planning of the resection and anatomical reconstruction. Moreover with the same technique it is possible to plan and perform bone cutting jigs to achieve matched contact between the host bone and the custom implant. The goal of this technique is to obtain first a perfect contact device with simple fixation, thus reducing the time of reconstruction.

Purpose:

The aim of this study is to report our preliminary experience about the use custom made bone cutting jigs and trabecular titanium prosthesis in treatment of bone sarcoma.

Material and methods

From August 2013 to April 2015, we treated 4 patients for bone pelvic sarcoma. Histology was Ewing sarcoma in 3 cases and chondrosarcoma in 1. Mean age was 27 years (range 18-35). Resection type (according with Enneking and Dunham classification) were II and III in 3 cases, while type II and partial III in 1.

From high definition CT series of the pelvis a 3D model is obtained by the engineer, thus, the physician indicates the osteotomy lines place and the type of fixation. Custom-made osteotomy jigs (Nylon) and custom-made trabecular titanium prosthesis have been produced through rapid prototyping technology.

Surgical approach is based on tumor size and site. Osteotomy jigs are placed onto the pelvis during surgery to guide the bone cuts. Custom prostheses is fit in the bone gap and fixed by plug and screws previously virtually oriented with previewed type and length. Post-operative CT scan was performed to evaluate the matching between bone and prosthesis. Then, the patients were evaluated clinically and radiographically (X-ray and CT scan) every 3 months after surgery according to the oncological follow-up.

Functional evaluation was performed by MSTs score.

Results:

In all patients the hip abductors could be saved during surgery. Wide margins were obtained in all cases and no local recurrences were evident to now. Time of surgery was about 4 hours on average (range from 200 to 250 minutes). All the Ewing's sarcoma patients received postoperative chemotherapy. Full weight bearing was allowed at mean time of 6 months.

No postoperative complications were observed in all cases. In one case mobilization of a screw in the pubic area was observed, however, without affecting the stability of the implant.

After a mean follow up time of 14 months the first 3 patients could obtain a satisfactory functional result (mean 24/30). No patient use supports and walk with evident limping. A mild pain with no need of painkiller is referred by two patients particularly on the ichium tuberosity while seating.

Postoperative CT scan showed a good matching between bone and prosthesis in all cases, however, signs of bone ingrowth from the host to the trabecular titanium was present only partially in the first patient performed.

The mean follow up was 14 months (range 6-21).

Conclusion:

Rapid prototyping is a promising technique able to perform high-precision 3D physical structures by the sequential addition of material layers. From CT data in few weeks is possible to achieve a device equipped with perfect bone cutting jigs. This early report showed as it possible to apply this technique in this very challenging orthopaedic field. Moreover, short surgical time, adequate margins, low rate of complications and good functional results can be obtained. More cases and longer follow up is needed to establish this technique as the future standard in reconstruction after pelvic resection as well as in revision THA surgery.