

SACRAL NERVE RECONSTRUCTION FOLLOWING 3D-GUIDED PARTIAL SACRECTOMY FOR CHORDOMA TO RESTORE URINARY; SEXUAL; AND BOWEL FUNCTION: A CASE REPORT

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INTRODUCTION

Sacral chordomas are rare malignant tumors characterized by slow growth but high local aggressiveness. Radical en-bloc resection remains the cornerstone of treatment to achieve long-term local control. However, tumor removal often requires sacrifice of sacral nerve roots, which can result in profound deficits of urinary, bowel, and sexual function. Sacral nerve reconstruction has been proposed as a strategy to mitigate these functional impairments^{1,2}.

In this case we report an innovative approach, which combines 3D-guided partial sacrectomy sub S2 with microsurgical reconstruction of the sacrificed sacral nerves to preserve neurological function in a young female patient.

CASE DESCRIPTION

A 29-year-old woman with no medical history presented with atraumatic progressive sacral pain of six weeks' duration. Neurological examination revealed no deficits with normal bladder and bowel function. MRI demonstrated an expansile lesion of the sacrum involving the level S3/4, and biopsy confirmed a conventional chordoma. Staging showed no evidence of metastasis or skip lesions. According to a multidisciplinary tumor board, the recommendation was en-bloc resection with subsequent consideration of adjuvant proton therapy.

SURGICAL PROCEDURE

Under general anesthesia and prone positioning, a midline incision was performed from the gluteal cleft cranially. Subcutaneous dissection and mobilization of the paraspinal muscles exposed the posterior surface of the sacrum from S1 to S2. During the operation, intraoperative neurophysiological monitoring was performed, including mapping of the sacral plexus. This revealed dominance of the left S3/S4 nerve roots.

Patient-specific cutting guides were applied. The first osteotomy through the laminae of S1 and S2 allowed access to the spinal canal. The S1 and S2 roots were carefully identified and preserved bilaterally, while the S3 and S4 roots were ligated and transected. A second patient-specific osteotomy was then carried out at the inferior margin of the S2 foramina, enabling en bloc mobilization of the sacrum. The presacral fat plane was developed bluntly to protect the rectum, and division of the sacrotuberous ligaments and coccygeal muscles completed the resection. The specimen was removed en bloc without complications.

Defects of approximately 5 cm were reconstructed with nerve allografts. Microsurgical perineurial sutures were performed and sealed with fibrin glue. On the left side, both S3 and S4 were reconstructed, while on the right side only S3 could be coapted because the S4 root was small.

Soft tissue coverage was achieved with bilateral gluteus maximus advancement flaps, which were mobilized and sutured in the midline to fully cover the defect.

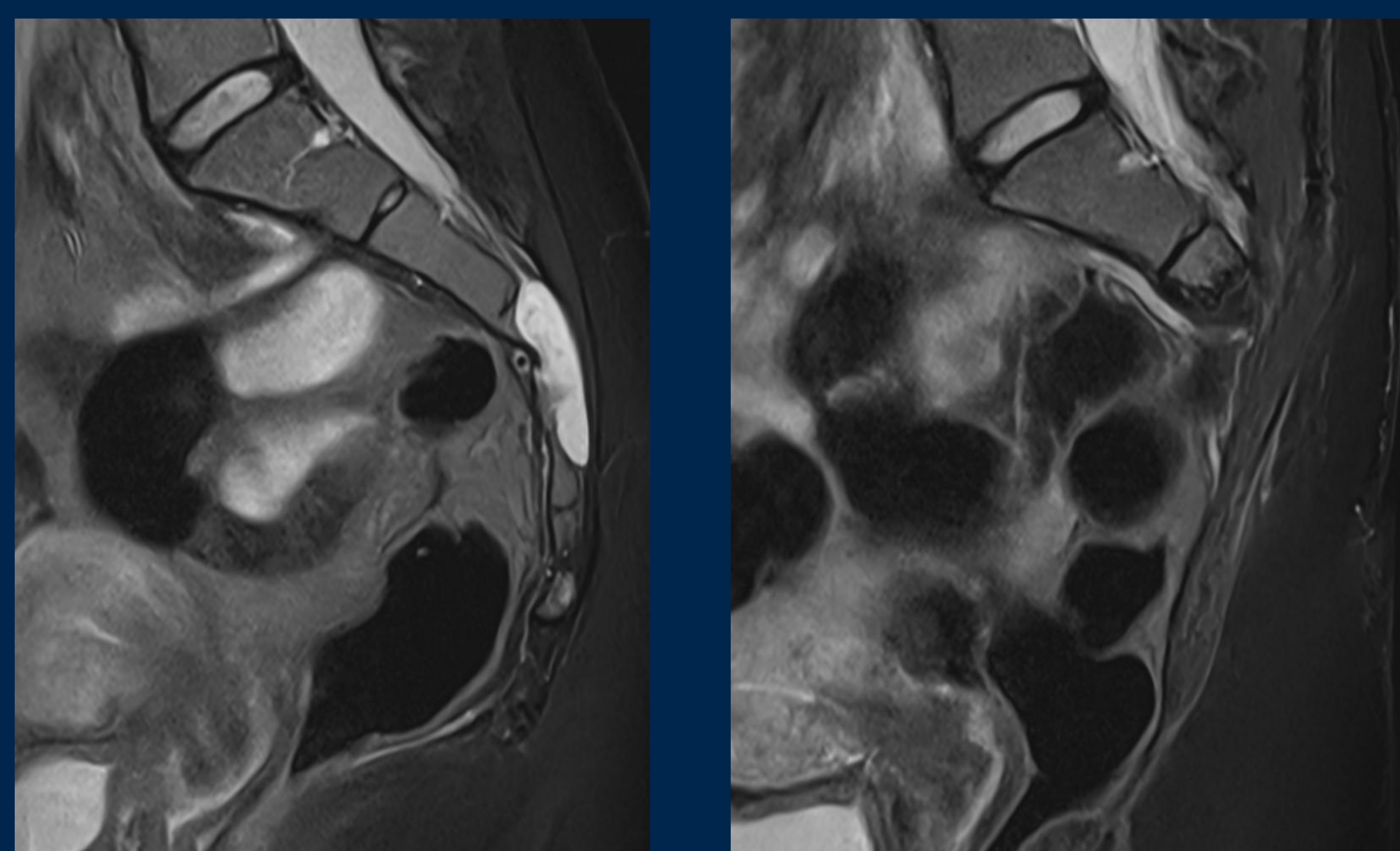


Fig. 1: Sacrum MRI pre- and postoperatively in lateral view

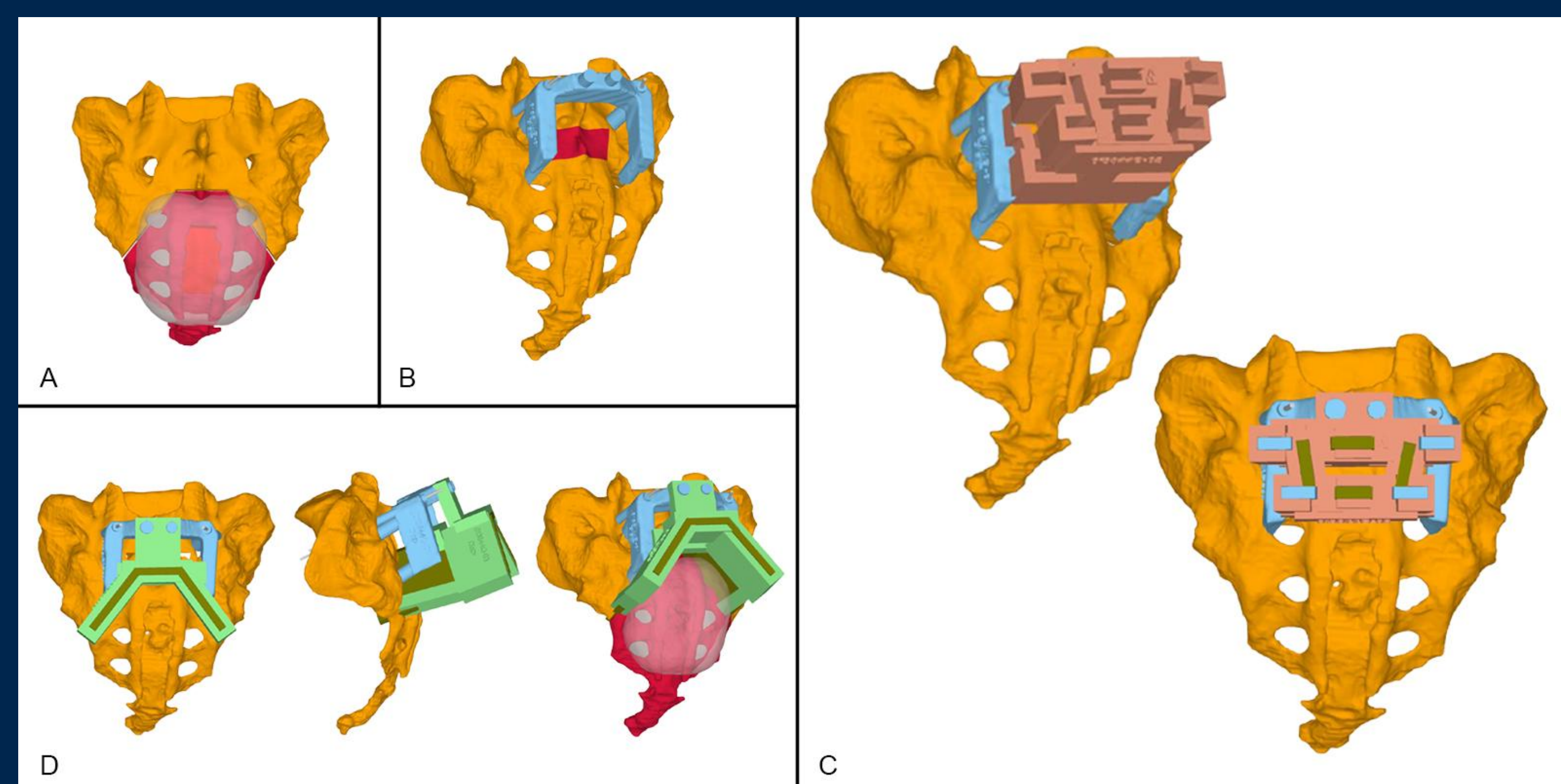


Fig. 2: Preoperative PSI Planning: A) Sacrum (orange), Tumor (light red), resection (red) with 1.5 cm resection margins. B) Sacrum (orange), Base block with 8 contact points and different attachments (blue), (not in the picture: 2 Kirschner wires connecting the base block with the sacrum.). C) Sacrum (orange), base block (blue), Osteotomy guide (brown) for deroofing of sacral canal and bilateral exploration of nerve roots S3 and the left S4 nerve root, connected with the base block. D) Sacrum (orange), Tumor (red), base block (blue), osteotomy guide (green) for transverse sacral amputation sub S2 with preservation of S1 and S2 nerve roots bilaterally.

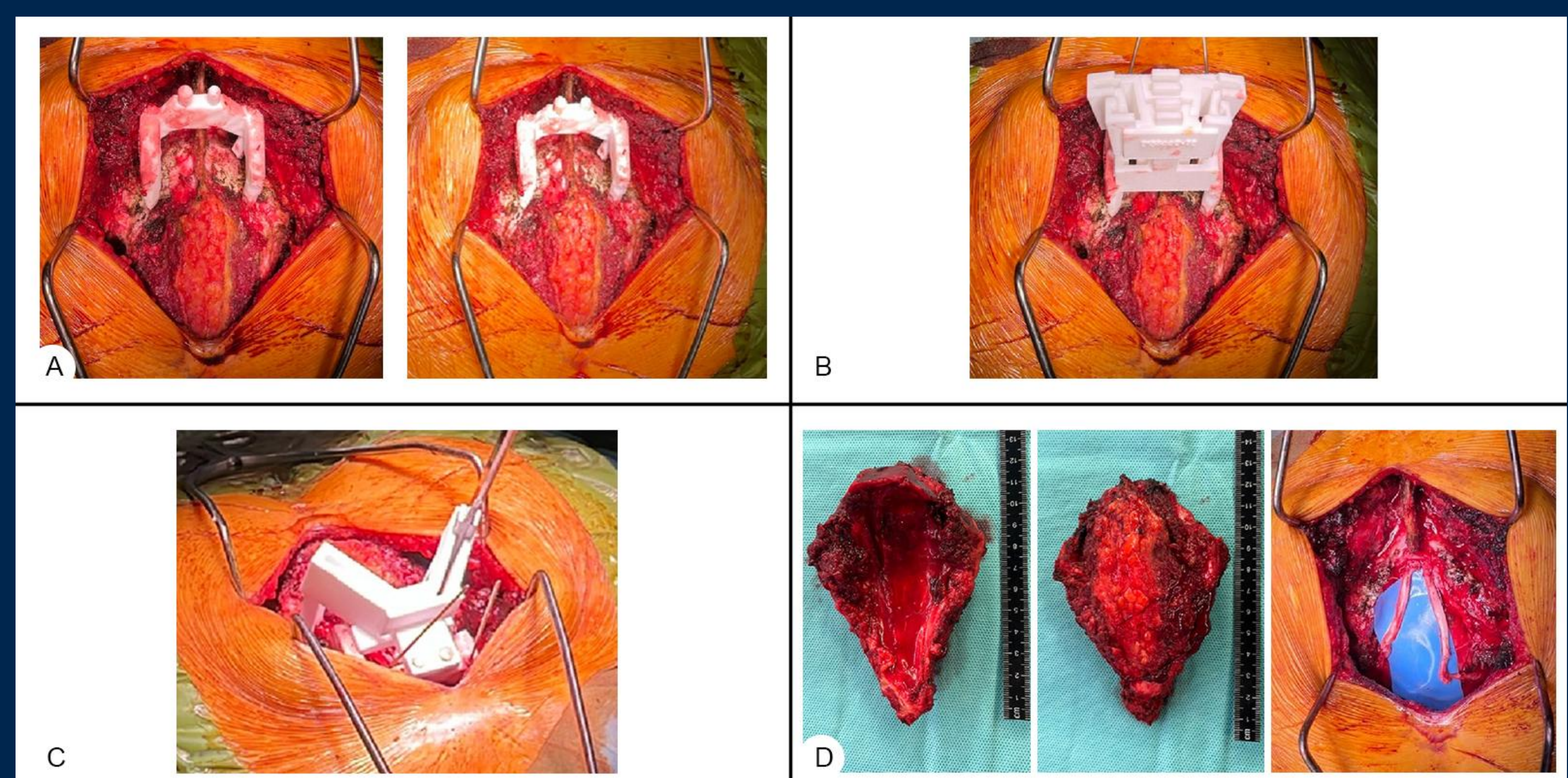


Fig. 3: A) Base block (white). B) Osteotomy guide for deroofing of sacral canal and bilateral exploration of nerve roots S3 and left S4 nerve root. C) Osteotomy guide for transverse amputation sub S2. D) Amputated Sacrum with tumor, Adaptation of nerve roots with nerve allografts.

RESULTS / FOLLOW-UP

Postoperatively, motor and sensory function of the lower limbs remained intact. However, as expected, the patient demonstrated loss of sphincter tone and perianal sensation directly after the surgery. Bladder dysfunction persisted, requiring intermittent self-catheterization for an acontractile bladder. Bowel function gradually improved with laxative therapy and physiotherapy, allowing the patient to retain and voluntarily evacuate stool.

At 6 months postoperatively, MRI demonstrated an R0 resection with no evidence of local recurrence. Neurological assessment showed persistent sensory deficits in S3–S4 dermatomes, but early reinnervation signs were evident on neurophysiological testing of the left side. Bladder dysfunction remained unchanged. The patient declined adjuvant proton therapy because of concerns regarding additional neurological compromise.

CONCLUSION

Microsurgical reconstruction of sacral nerves following oncological resection appears to be a promising strategy to improve autonomic and pelvic floor function in patients undergoing surgery for sacral chordomas. The combination with 3D-guided osteotomy enhances surgical precision and facilitates nerve-sparing strategies. Further follow-up is required before definitive conclusions can be drawn.

1 D'Alessandris et al., Neurosurg Rev 2022

2 Rupen et al, MDPI 2024