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Cemented endoprosthetic intercalary replacement for pathologic fracture of the clavicle with a modular custom-made titanium spacer: a case report

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Introduction: Disability associated with pathological fractures of the clavicle can be substantial, good treatment options however, are limited. Conservative treatment is hardly ever successful, simple resection does not always provide predictable pain relief or restoration of function and internal fixation with or without cement augmentation using intramedullary devices or locking plates is prone to failure, particularly when the disease process already involves large portions of the remaining bone.
Methods: We report the case of a 46-year old female patient with a pathological clavicle fracture due to myelomatosis, which was treated with an OsteoBridge Small Bone titanium spacer fixed with custom-made, cemented intramedullary titanium nails. Calculations of the expected bending forces, based on a computational model for internal fixation of the clavicle and the pre-operative imaging were used to design a range of optimally shaped and dimensioned titanium nails.
Results: Pre-operative CT scans demonstrated that only 3cm of intramedullary canal with a diameter of 4.5mm laterally and 5.5mm medially were available for intramedullary fixation after projected resection for the 4cm intercalary spacer. Calculated safe transmission of bending moments for 4.5mm, 5mm and 6mm nails were 4Nm, 6Nm and 10Nm respectively, indicating that the surgical effort was to be directed towards accommodating the largest possible nail, in order to achieve the strongest possible bone-cement-nail composite beam construct. Calculations also revealed that the desired 20 degree bend in the 4.5mm nail was not of sufficient strength. Implantation was performed through a standard transverse incision, intramedullary reaming with a straight drill and standard cementation. Post operative imaging demonstrated satisfactory implant position and the patient maintains pain free function at 1 year follow up.
Conclusion: Cemented endoprosthetic intercalary replacement with a modular custom-made titanium spacer is technically feasible and may develop into a promising treatment option for pathological clavicular shaft fractures in the future.