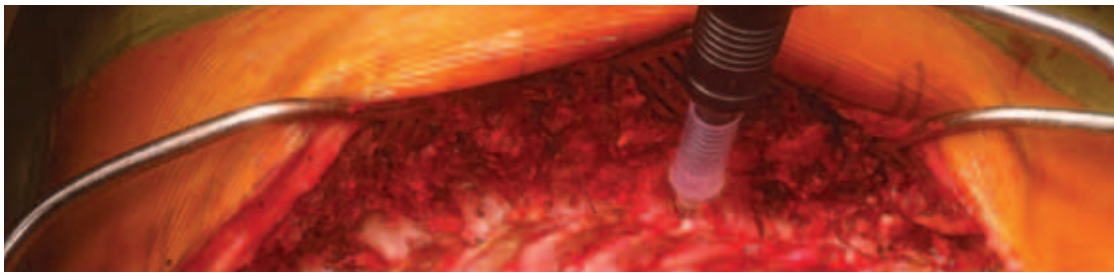
Use of ultrasonic BoneScalpel in spine surgeries: experience from the first 128 patients

Submitted for publication



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Summary
We reviewed 128 consecutive patients who underwent spine surgery with the use of the ultrasonic BoneScalpel. The operation time, blood loss and intraoperative complications were recorded. In all instances the BoneScalpel was able to efficiently create the needed osteotomies to facilitate the surgical procedure without any percussion on the spinal column or injury to the underlying nerves.

Introduction
The ultrasonic BoneScalpel is a tissue specific device that allows the surgeon to make precise osteotomies while protecting collateral or adjacent soft tissue structures. The device is comprised of a blunt ultrasonic blade that oscillates at over 22,500 cycles per second with an imperceptible microscopic amplitude. The recurring impacts pulverize the non compliant crystalline structure resulting in a precise cut. The more compliant adjacent soft tissue is not affected by the ultrasonic oscillation.

Methods
Data were retrospectively collected from medical charts and surgical reports following each surgery in which the BoneScalpel was used to perform any manner of osteotomy (facetectomy, laminotomy, etc.). All surgeries were performed at the same hospital by a single surgeon. The majority of patients had spinal stenosis, degenerative or adolescent scoliosis, pseudoarthrosis, adjacent segment degeneration, and spondylolisthesis et al. The technical advantages and intra-operative complications were also recorded.

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Results

There were 73 females and 55 males with average age of 58 years (range 12-85). Eighty patients (62.5%) had previous spine surgery and/or spinal deformity. The ultrasonic BoneScalpel was used at all levels of the spine and the average levels operated on each patient were 5. The mean operation time (skin to skin) was 4.3 hours and the mean blood loss was 425.4 ml/patient. In all instances the BoneScalpel was able to efficiently create the needed osteotomies to facilitate the surgical procedure without any percussion on the spinal column or injury to the underlying nerves.

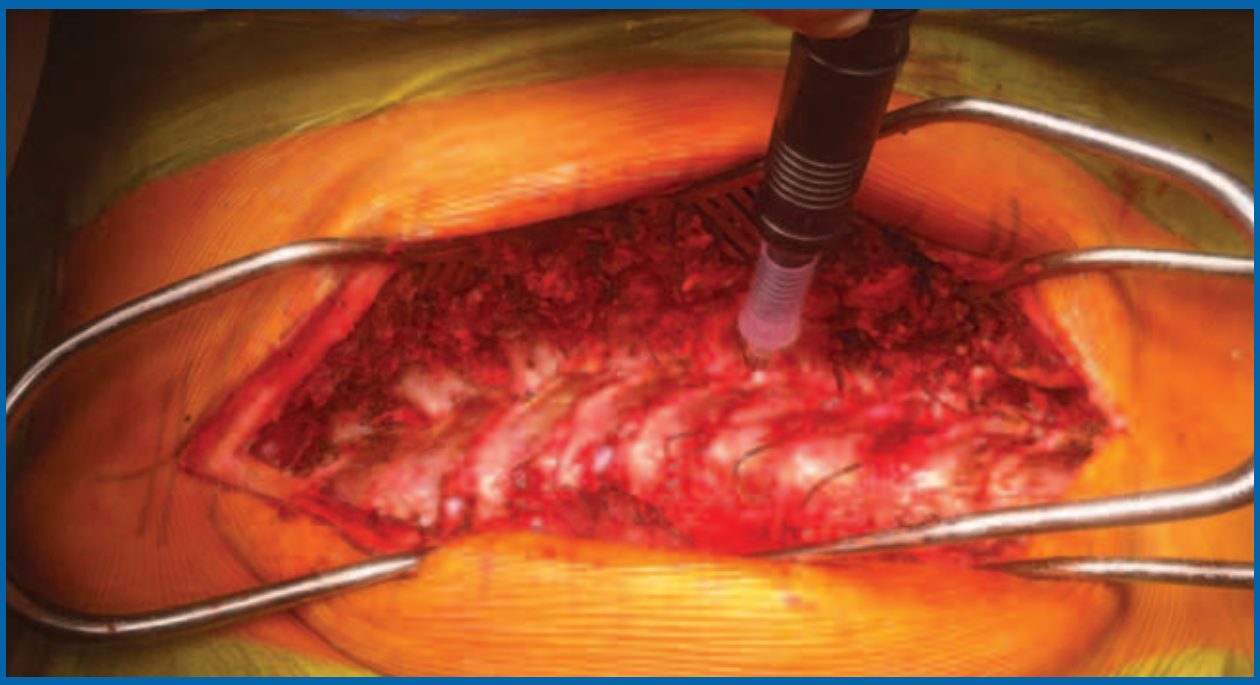
Primary Diagnosis	Cases
Spinal stenosis	24
Degenerative scoliosis	15
Pseudoarthrosis	15
Adjacent segment degeneration	11
Idiopathic scoliosis	11
Degenerative spondylolisthesis	10
Disc herniation	9
Flat back syndrome	7
Metastatic spine tumor	5
Vertebral compression fracture	3
Congenital scoliosis	2
Kyphosis	2
Loosened hardware	2
Sacral fracture	2
Scheuermann's kyphosis	2
Spinal spondylosis	2
Spinal tumor	2
Multiple myeloma	1
Vertebral sarcoma	1
Epidural hematoma	1
Pseudoarticulation	1
Total cases	**128**

Table 1. The primary diagnosis of the ultrasonic BoneScalpel cases.

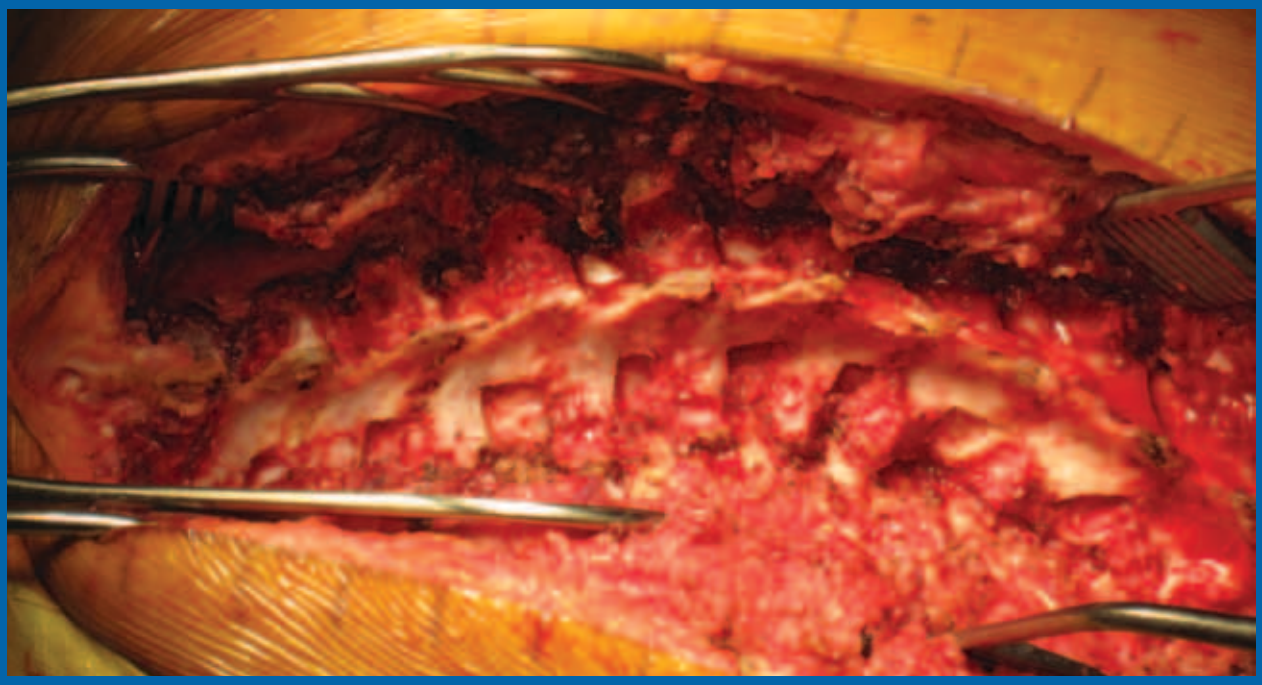
There was a noticeable absence of bleeding from the cut end of the bone consistent with the ultrasonic application. There were two instances of dural injury. One was a 3 mm dural thermal injury which resulted from the overheating of the local tissue by the BoneScalpel blade sitting in one position. The other dural injury occurred in a revision case where the dura was adherent and partially ossified. In both cases, the dual injury was over sewn with a water tight closure. No other intra-operative complications directly related to the BoneScalpel were encountered. With increasing experience, more complex osteotomies are easily created.

Conclusions

The BoneScalpel is a safe and effective ultrasonic bone cutting device that can be used to facilitate osteotomies in a variety of spine surgeries. This device eliminates the risk of soft tissue injury associated with the use of high speed burrs and oscillating saws during spine surgery.

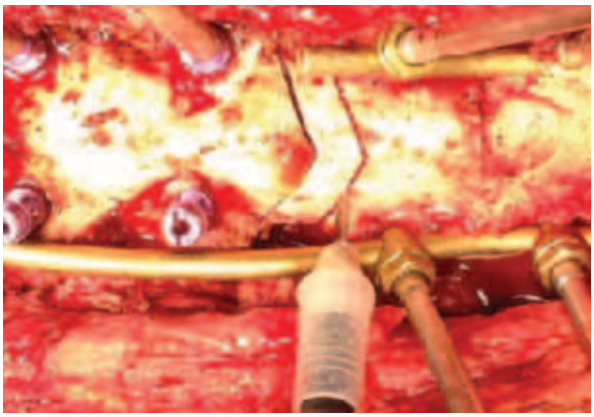


A



B

Figure 1. Intraoperative images showing BoneScalpel creating facetectomies (A) and the completed facetectomies (B) for a scoliosis patient.



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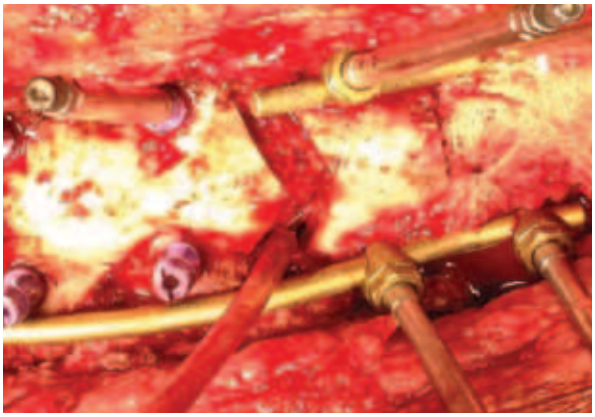

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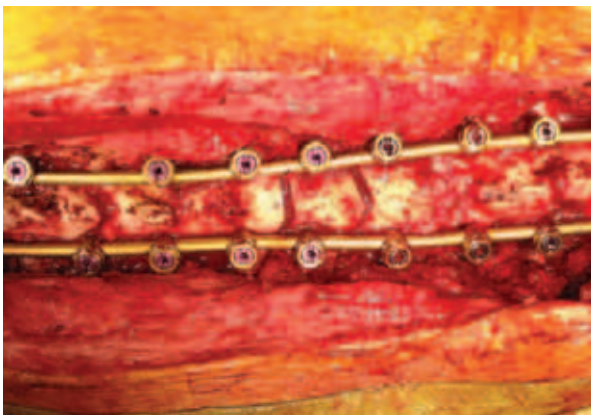

C

Figure 2. Intraoperative images showing the use of ultrasonic BoneScalpel during (A, B) and after (C) osteotomies in a revision kyphosis surgery.

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