Unilateral partial pediculectomy combined with contralateral instrumented fusion in treatment of osteoid osteoma localized in lumbar spine pedicles

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Background
Treatment of osteoid osteoma of the spine may be challenging when located in the pedicles.
Patients and methods
Twelve patients with osteoid osteoma located in lumbar spine pedicles were treated via partial pediculectomy to excise the nidus completely combined with contralateral instrumented fusion to prevent instability. Their demographic data, back pain as measured by visual analog scale, and radiographs were recorded and analyzed. The patients were followed up for a period of at least 12 months.
Results
Their mean age was 18.1 years. Nine were males and three females. The mean preoperative visual analog scale was 8. This improved to 2.5 1 month after surgery and 0.83 at the final follow-up ($P<0.001$). The mean operative time and blood loss were 124 min and 660 ml, respectively. Fusion was obtained in all cases.
Conclusion
When lesions with a relatively large nidus involve the pedicle, partial pediculectomy to access the nidus combined with contralateral instrumented fusion appears to be an effective and justifiable method of treatment.

Keywords:
lumbar spine, osteoid osteoma, partial pediculectomy

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Introduction

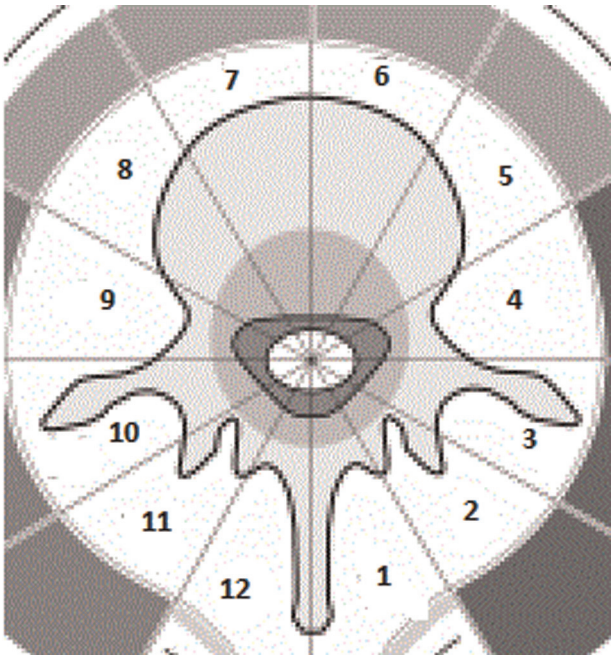
Osteoid osteoma (OO) is a primary benign osseous lesion, first described by Jaffe in 1935 [1]. Around 10–25% occur in the spine with involvement of the posterior elements in ~75% of those cases [2,3]. The patients commonly present in the second decade of life with male predominance (2 : 1). Night pain is commonly described, reportedly in up to 100% of cases. Painful scoliosis is another common presentation with its incidence around 70% [4–6]. The lesion can be localized using Technetium-99 bone scan with high sensitivity. Computed tomography and MRI can also help in diagnosis as well as having a therapeutic role [7]. Nonsteroidal anti-inflammatory drugs and aspirin relieve pain in 14–90% of cases [5,8]. Surgery is effective in pain relief where total nidus excision is performed. Minimally invasive treatment options, such as percutaneous radiofrequency coagulation and laser photocoagulation, have also been described with favorable outcomes [9,10].

Pars interarticularis is the site commonly involved in the spine. Pedicles are reported to be involved in 15% of cases [3,10]. When located there, total nidus excision could occasionally be difficult and inadvertently requires violation of the nearby facet, especially with a relatively large nidus size [3,11,12]. A less-aggressive approach could lead to incomplete removal, residual pain, or recurrence. As facet violation could lead to segmental instability, we present a technique where partial pediculectomy ensuring complete nidus excision is performed combined with contralateral instrumented fusion. The results of the treatment are reviewed.

Patients and methods

Twelve consecutive patients diagnosed with OO involving a single pedicle in the lumbar spine were included in this study. The study was approved by the institutional ethics committee in the Orthopedic Department of Orthopaedic Surgery, Ain Shams University, Cairo, Egypt. The study was conducted after approval of the Ethic Committee of our university. Written consent was obtained from all patients before inclusion in the study. The lesions were diagnosed and localized using bone scan, computed tomography, and MRI. According to

Figure 1



Weinstein–Boriani–Biaginin classification for spinal tumors. Surgery was performed on osteoid osteoma located in sectors 4 or 9 with or without extension into the adjoining vertebral body (sectors 5 or 8).

Weinstein–Boriani–Biaginin classification [13], the lesions were located in sectors 4±5 or 9±8 (Fig. 1). Patients with lesions not in the pedicle, or a small nidus size that could be easily removed via simple intralesional excision, were excluded from the study. The demographic data of the patients were recorded. Other documented parameters included the duration of symptoms till diagnosis, the level as well as the side affected, and the severity of back pain as measured by visual analog scale (VAS).

Patients were placed prone on the operative table and posterior midline incision was employed. Surgery involved facetectomy and laminectomy on the involved side to facilitate partial excision of the pedicle enveloping the nidus. The dura and the nerve roots were retracted while the pedicle was being addressed. High-speed burr was used from the inner to outer cortex of the pedicle as well as adjoining the posterior vertebral body to ensure complete nidus excision. Thorough curettage was also done. On the contralateral side, pedicle screws were inserted into the affected vertebra and the adjoining one above it. Fusion was performed on that side using morselized local bone either posterolateral and facetal combined, or interbody (with or without a cage). The excised nidus was sent for histopathological diagnosis and confirmation.

Mean operative time and blood loss were recorded. Any complication related to the procedure was also noted. The patients were followed up for a period of at least 12 months. Images were performed immediately postoperatively, at 4 weeks after surgery and at the 3-month interval thereafter to assess any implant failure, segment fusion, and recurrence. The segment was considered fused when bridging bony trabeculae could be detected in the follow-up images.

VAS score for back pain was documented at 1 month after surgery and at the final follow-up. The scores were compared with the preoperative values. Statistical analysis was performed using repeated-measures analysis of variance. *P* values less than 0.05 were considered as being significant, less than 0.001 as highly significant.

Results

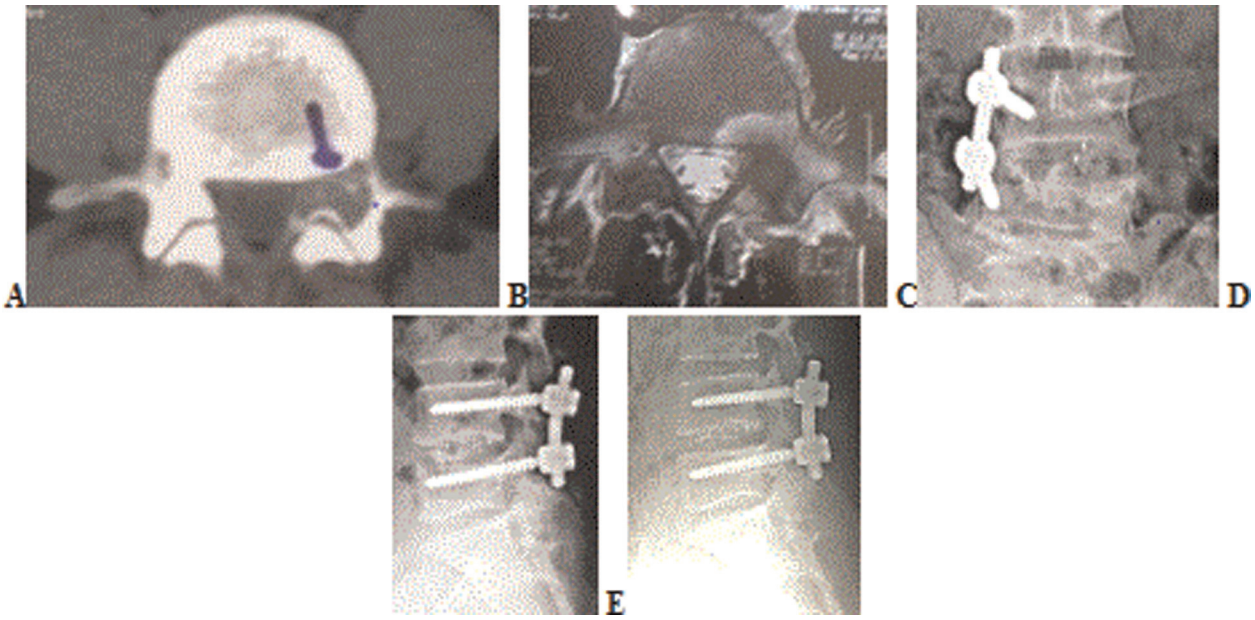
Nine males and three females were included in this study. Their mean age was 18.1 years old (range: 13–28). L5 was involved in four cases, L4 in four, L3 in two, and L1 in two. All lesions were located in the pedicle at one side. The left pedicle was involved in seven cases and the right in five cases. All patients presented with relentless back pain for a mean period of 12.5 months prior to diagnosis and surgery. Painful scoliosis was present in five cases. Their mean VAS was 8. All patients were neurologically free. The mean operative time and blood loss were 124 min and 660 ml, respectively. Blood transfusion was required during surgery in two cases due to excessive bleeding. Superficial wound infection occurred in a single case that resolved with antibiotics. Dural tear occurred in another patient, which was repaired with no leukorrhea postoperatively.

The patients were followed up for a mean period of 19.6 months. The mean VAS improved after surgery to 2.5 at 1 month after surgery and 0.83 at the final follow-up. The improvement was statistically highly significant with *P* value of less than 0.001. Scoliosis resolved in all five patients. The curves resolved completely after 6–8 months following surgery. Follow-up images showed no screw breakage nor radiologic evidence of recurrence. Fusion could be noted in all cases at the final follow-up with bridging bony trabeculae (Figs 2 and 3). Clinical and demographic data are summarized in Tables 1 and 2.

Discussion

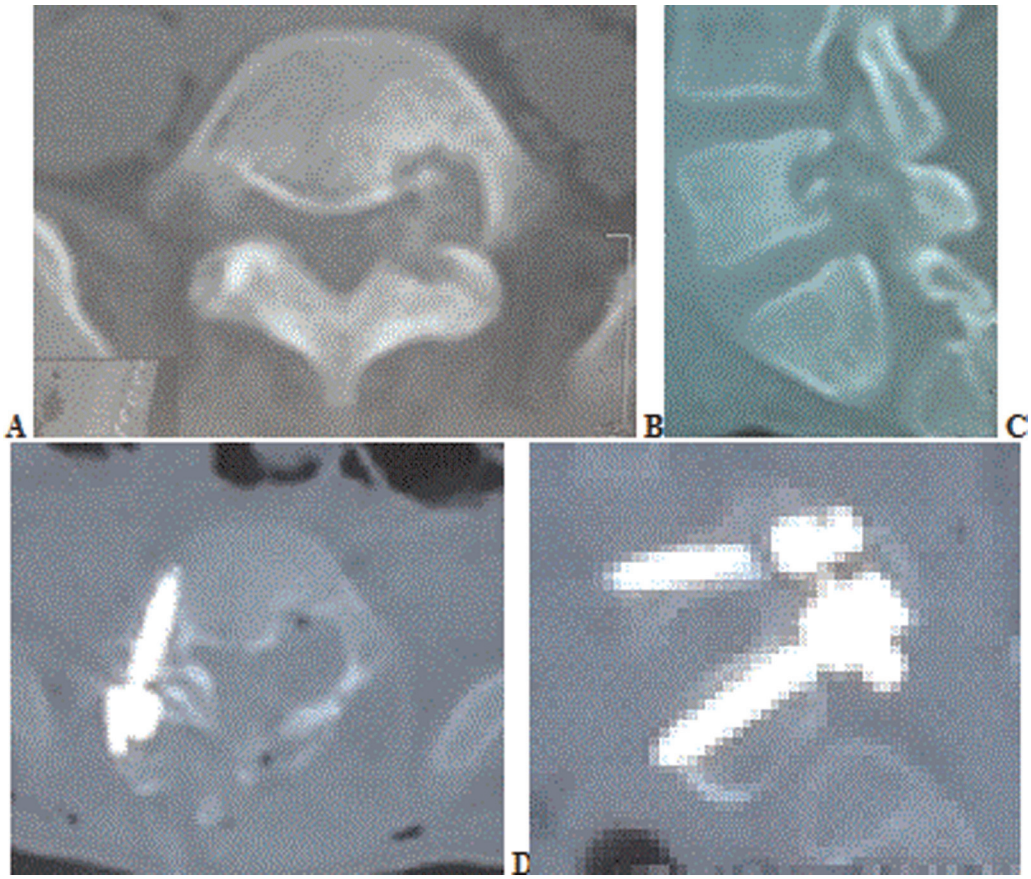
OO involving the spine is usually treated surgically. Pain is persistent and severe, deteriorating at night. The nidus produces prostaglandins stimulating nerve endings present within the lesion causing pain.

Figure 2



A 20-year-old male presented with low back pain increasing at night. His images revealed an osteoid osteoma involving L5 left pedicle (Weinstein–Boriani–Biaginin 4). Excision was performed combined with contralateral interbody fusion. (a, b) Axial computed tomography and MRI cuts showing the lesion. (c, d) Anteroposterior and lateral radiographs 3 months after surgery and (e) lateral plain radiograph 1 year after surgery. Note the bridging bony trabeculae within the cage.

Figure 3



Thirteen-year-old boy with osteoid osteoma involving the left pedicle of L5 (Weinstein–Boriani–Biaginin 4+5). (a, b) Preoperative axial and sagittal computed tomography cuts showing the lesion. (c, d) Postoperative axial and sagittal computed tomography cuts following excision and contralateral L4/L5 posterolateral fusion.

Table 1 Demographic and clinical data of the patients

No.	Age (years)	Sex	Duration of pain (months)	Scoliosis	Level	Pedicle side	Preoperative VAS	1-month VAS	Final VAS
1	20	M	12	–	L5	Lt	9	3	1
2	13	M	11	–	L5	Lt	8	3	1
3	18	M	13	–	L3	Rt	9	2	0
4	28	M	9	+	L4	Rt	7	3	1
5	14	F	16	–	L1	Lt	9	2	0
6	15	M	26	–	L5	Rt	8	1	1
7	18	M	15	+	L4	Rt	6	1	0
8	17	F	16	–	L4	Lt	8	2	1
9	21	M	5	–	L3	Lt	9	3	2
10	16	F	9	+	L5	Rt	8	3	1
11	18	M	6	+	L1	Lt	7	3	0
12	19	M	12	+	L4	Lt	8	4	2

F, female; Lt, left; M, male; Rt, right; VAS, visual analog scale.

Table 2 Mean VAS for back pain before and after surgery

	Preoperative	Postoperative 1 month	Final follow-up	*P* value
VAS	8	2.5	0.83	<0.001

VAS, visual analog scale.

Scoliosis may be present due to painful asymmetrical muscle spasm [5,14]. All cases in our series presented with back pain and scoliosis was found in five cases (42%), which was less than the reported 63–70%. This could be due to the relatively small number of patients in our series.

In our current series, 75% of the patients were males with a mean age of 18.1 years. These are in concordance with other studies where OO is seen more in males in their second decade of life [3,5,6,11,15].

The mean duration of pain until diagnosis was made was 12.5 months. Most cases sought medical advice elsewhere before presenting at our university. The reported period in other studies was between 15 and 20 months [5,11,15]. High index of suspicion to order appropriate imaging is the key to early diagnosis, especially in young patients with night pain and painful scoliosis.

Intralesional excision remains the conventional surgical treatment of these lesions [16–18]. Following the success of minimally invasive procedures as PLC and laser photocoagulation in treatment of extraspinal lesions, studies reported on treatment of spinal lesions with such maneuvers without complications, despite their proximity to vital structures [19,20].

However, the choice of treatment is greatly dictated by the location of OO within the spine. The more anteriorly located the lesion (Weinstein–Boriani–Biaginin 5–8), the more the conventional excision is preferred. Thermoablation also risks damage to neural structures reducing its use in spinal surgeries [3]. In addition, the availability of special probes and devices for the minimally invasive procedures remains a problem, especially in less-privileged communities.

When lesions are relatively large or difficult to access, more aggressive approaches may be required to achieve complete nidus excision. In such procedures, instrumentation and fusion may be necessary to prevent spinal instability. In a large series by Gasbarrini *et al.* [3], posterior instrumented fusion was performed in four patients. Posterior instrumented fusion due to facet resection was performed in two out of 18 cases (fusion in a total of four cases) in a study conducted by Etemadifar *et al* [11]. Overall, instrumented fusion has been reported for 20–50% of cases undergoing OO excision [3,11,12].

A posterior aggressive approach was used to treat our patients to ensure complete nidus excision. Due to facet violation during our approach, posterior instrumented fusion was performed in all our cases. The pedicle was partially excised in order to reach the lesion on the affected side. But instead of performing instrumented fusion on the affected side that would require sacrifice of further spinal segment below the affected vertebra by placing pedicle screws above and below that vertebra, unilateral contralateral instrumented fusion was performed for the affected vertebra and the one above. Unilateral lumbar fusion has been previously described in several studies with favorable results for degenerative pathologies. No significant difference could be found between unilateral and bilateral screw instrumentation as regards fusion rate in a systematic review conducted by Molinari and colleagues [21,22]. In our cases,

100% fusion rate could be obtained in our cases with no implant failures at the final follow-up.

Local recurrences are rare with conventional excision ranging from 4.5 to 5% [3,23]. In our patients, although the lesions involved the pedicles and the adjoining parts of the vertebral bodies making their access not as easy as the more common posterior lesions, no case of recurrence was recorded.

The procedure provided immediate pain relief by ensuring complete nidus excision, as evidenced by the improvement in VAS for back pain at 1 month after surgery. The improvement was maintained as well on the long term at the final follow-up, by preventing recurrence, segmental instability, or pseudarthrosis.

Conclusion

Surgical intralesional excision remains the conventional procedure to treat OO in the spine. When lesions with a relatively large nidus involve the pedicle, partial pediculectomy to access the nidus combined with contralateral instrumented fusion appears to be an effective and justifiable method of treatment. A larger number of patients are required to overcome our study limitation.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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