

# Intraforaminal O<sub>2</sub>-O<sub>3</sub> Infiltration: Use of CT Guidance in Case of Accidental Puncture of the Periganglionic Venous Plexus

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**SUMMARY** - We describe a patient with a left preforaminal L2-L3 herniated disc treated with oxygen-ozone therapy under CT guidance. The gas mixture was infiltrated using appropriate precautions following specific guidelines. Despite this, a local embolism developed with gas emboli in some stretches of the external and internal venous plexus involving the basivertebral vein and its branches. CT guidance proved particularly useful in depicting the presence of gas in anatomical locations other than the foraminal and periganglionic areas. This study confirms the need to use small volumes of O<sub>2</sub>-O<sub>3</sub> which are still effective and avoid needless risks in case of inappropriate distribution of the gas mixture.

## Introduction

The growing recent use of radiologically guided infiltration procedures has increased the safety and efficacy of ozone therapy to treat herniated discs. One of the important features of CT use in controlling O<sub>2</sub>-O<sub>3</sub> infiltration is visualizing the distribution of the gas mixture in the foraminal region under treatment and to check for any anomalous gas leaks at epidural and/or vascular level.

We describe the case of a local embolism after right L2-L3 foraminal O<sub>2</sub>-O<sub>3</sub> infiltration with the demonstration of gas emboli in some stretches of the external and internal venous plexus, involving the basivertebral vein and its branches. The gas leak was probably caused by accidental puncture of the intervertebral vein and/or radicular veins which are non collapsible resulting in local embolization. The leak occurred despite the extreme care taken in positioning the needle and performing the aspiration manoeuvre. This incident offers further proof of the importance of using small volumes of gas for effective treatment of herniated disc avoiding the major problems linked to embolism in case of O<sub>2</sub>-O<sub>3</sub> leakage.

## Case Report

A 58-year-old man presented with left low back pain due to a preforaminal L2-L3 herniated disc demonstrated by recent magnetic resonance scan

(figure 1 A,B). Given the clinical and radiological coincidence between the level of the herniation and the patient's symptoms, treatment with CT guided foraminal O<sub>2</sub>-O<sub>3</sub> infiltration was decided according to the standard procedure<sup>3</sup>. The patient was placed in a prone position on the CT table and a lateral view topogram was obtained with subsequent accurate localisation of the established level. After the necessary measurements and careful disinfection and local anaesthesia, a 22 G 9 cm needle was inserted at an entry angle of 45° down to the foraminal region to be treated. According to the usual procedure, an aspiration manoeuvre was performed with the syringe before O<sub>2</sub>-O<sub>3</sub> infiltration. Then a *total volume* of 8-10 ml gas mixture at a concentration of 27 micrograms/ml was injected *slowly*<sup>12</sup>.

Distribution of the gas mixture was subsequently checked with CT scans which demonstrated the expected filling of the foraminal and ganglionic regions (figure 2 A,B), but also an associated embolism in some stretches of the external and internal venous plexus mainly involving the basivertebral vein and its branches (figure 3 A,B). The patient referred local pain lasting several minutes and was monitored clinically for two hours in a supine position and was contacted by telephone on several occasions some hours and days after the procedure. At outpatient follow-up 12 days later the patient described a rapid and complete disappearance of pain without other symptoms correlated to gas embolism.

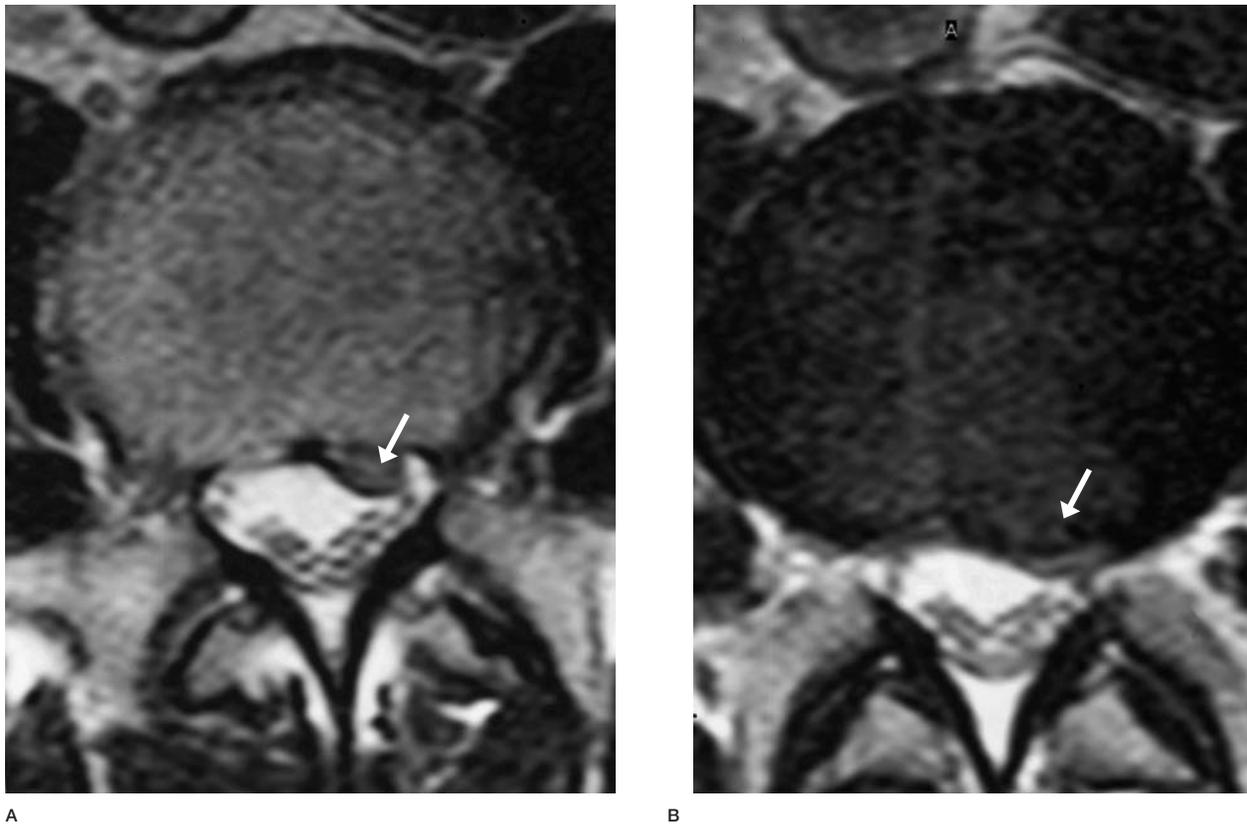


Figure 1 A-B) MR: left preforaminal L2-L3 herniated disc (arrows).

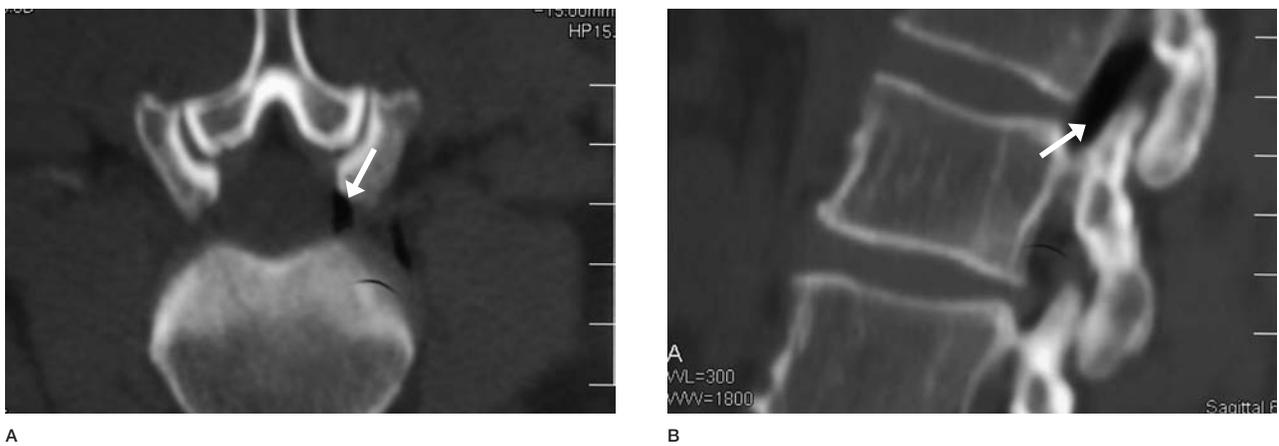


Figure 2 A) CT axial scan showing the presence of gas in the foraminal region after O<sub>2</sub>-O<sub>3</sub> treatment (arrows). B) CT sagittal reconstruction confirming the gas mixture in the left L2-L3 root canal (arrows)

## Discussion

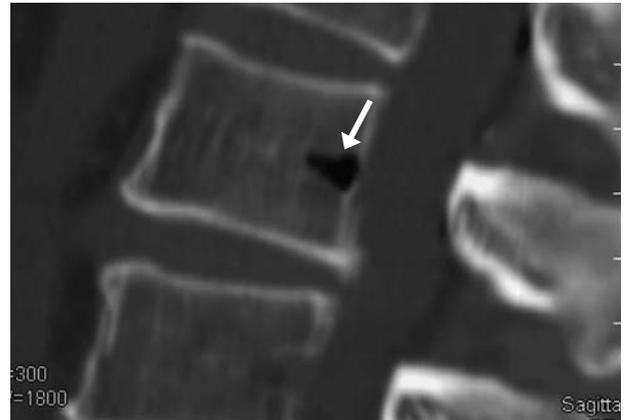
CT guided intraforaminal O<sub>2</sub>-O<sub>3</sub> infiltration resolves pain from the first treatment session and has rapid effects on nerve root compression<sup>1,3,4,6,9,11</sup>. This is largely due to the possibility of delivering the gas mixture very close to the diseased area, improving the local circulation and normalizing

cytokine and prostaglandin levels (anti-inflammatory and analgesic effect). Ozone also has a direct effect on the disc accelerating dehydration and hence disc shrinkage (attenuated mechanical effect)<sup>2,5,7,10,11</sup>.

According to the technique adopted the needle tip is positioned as close as possible to the root canal. This small oval structure is made up anteriorly



A



B

Figure 3 CT image of gas embolism in the basivertebral vein (arrows).

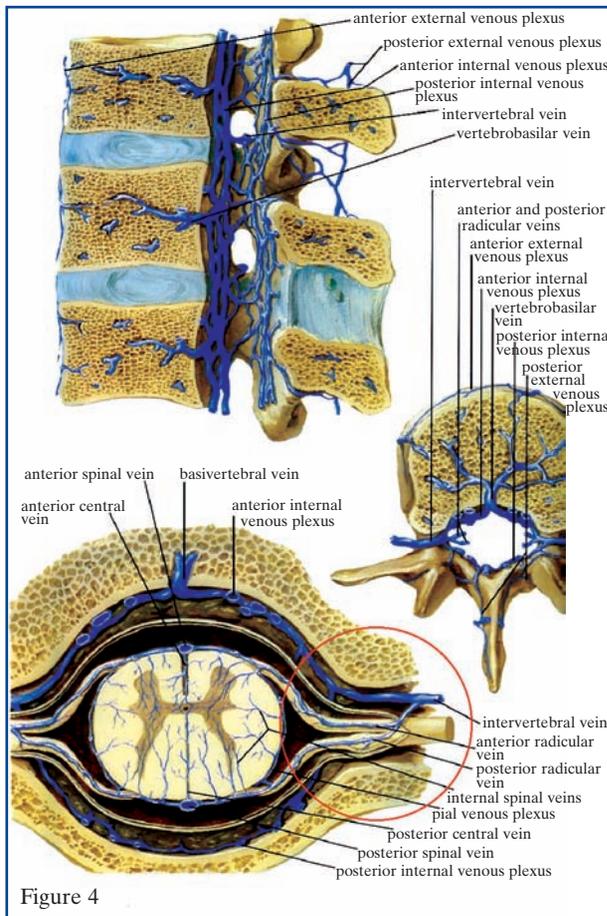
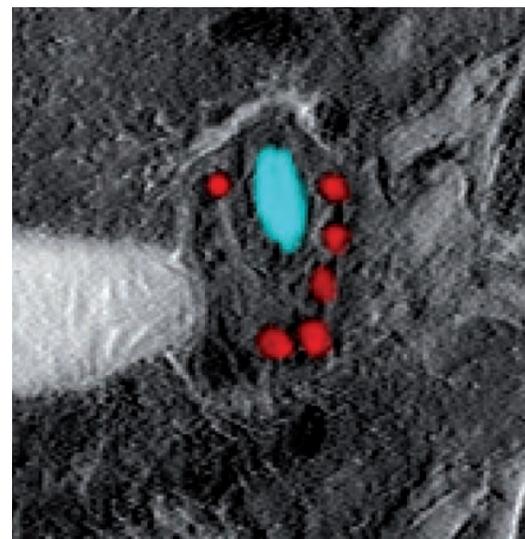


Figure 4

only of the posterolateral margin of the vertebral body and the intervertebral disc, posteriorly the intervertebral joint, superiorly the peduncle of the overlying vertebra and inferiorly the peduncle of the underlying vertebra. The delicate content of the root canal comprises the anterior and posterior nerve roots (with the spinal ganglion) and lower down the radicular artery and veins and the



A



B

Figure 5 Anatomic drawing (from a cadaver) of the root canal: nerve root (blue), venous plexus (red).

intervertebral vein (figure 4). It is understandable how a small part of the O<sub>2</sub>-O<sub>3</sub> mixture can pass into the venous vascular district when it is injected close to these structures, despite all the necessary precautions.

No complications of O<sub>2</sub>-O<sub>3</sub> therapy have ever been reported in the many case studies published to date<sup>1,3,4,6,9</sup>.

In the case of possible venous gas embolism the physiological filter of the pulmonary circulation acts as an effective protection against gas volumes below 50 ml and in these cases the venous embolism may go unrecognised. Nonetheless it is important to use low amounts of O<sub>2</sub>-O<sub>3</sub> to avoid the risk

of paradoxical emboli which may occur even in the absence of evident intracardiac defects or other detectable shunts<sup>8,12</sup>.

For this reason we recommend administering the O<sub>2</sub>-O<sub>3</sub> mixture at a flow rate below 10 ml/min and at single doses not exceeding 10 ml<sup>12</sup>. This is even more important in the case of foraminal infiltrations which allow the mixture to be inserted "only where needed" and hence requiring even smaller gas volumes, but at the same time introducing the gas close to non collapsible veins like the dural venous sinuses and emissary veins of the sinuses.

These precautions will avoid severe complications even if O<sub>2</sub>-O<sub>3</sub> leakage does occur.

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