Interventional radiology: Transoral approach to C2

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Materials and methods

Between 1996 and 2006, fluoroscopy guided percutaneous approach to the C2 vertebra was performed in 4 patients, aged 9 to 67 years. The procedure was performed for biopsy of isolated lytic lesions of C2, confirmed on CT, MR and scintigraphy in 3 cases. The transoral C2 biopsies were performed with patients in the supine position with head slightly extended, under general anesthesia with orotracheal intubation and inflated cuff, pharyngeal packing, use of oral retractor and tongue depressor, under sterile technique with the use of betadine and biplane fluoroscopy guidance (fig. 1). Direct transoral approach to C2 was performed using 13-gauge bone biopsy needles or trocar needle with stylet for vertebroplasty. A coagulation profile was obtained in all patients. Prophylactic per-os antibiotics were given to all patients. A pre-anesthesia consult was also obtained for all patients. Our patient population included:

- 8 year old patient presenting with cranio-cervical junction pain after a minor trauma during judo, with poor response to pain medication. The base of the odontoid showed a heterogeneous lytic appearance on CT and signal abnormalities and enhancement on MRI. Scintigraphy showed increased uptake at C2. Because of diagnostic uncertainties and given the worrisome appearance of the lesion, biopsy was performed at the request of pediatricians and neurosurgeons.
- 55-year-old patient (fig. 2) with neck pain of 6 months duration showing a lytic lesion of C2 on radiographs, confirmed on CT. Scintigraphy showed isolated increased uptake at C2. The patient was referred for transoral biopsy of C2.
- 61-year-old patient receiving triple-therapy for pulmonary and renal tuberculosis for 2 months presenting with severe neck pain. The base of the odontoid was ill defined on plain radiographs and CT showed a lytic process of the C2 body and odontoid process. MRI showed abnormal T1 hypointensity and T2W hyperintensity of C2 with marked enhancement following contrast administration as well as extension to the surrounding soft tissues. The patient was referred for transoral biopsy of C2.

A few case report publications (1-5) have described this approach at the time of C2 biopsy or vertebroplasty. Over the last 10 years, we have used a transoral approach to C2 in 4 patients, at the time of biopsy in 3 cases, and vertebroplasty in 1 case. We report our experience with these 4 cases.

Abstract

Purpose: To assess the value of a direct transoral approach to C2 for interventional procedures.

Materials and methods: A transoral approach to C2 was used in 4 patients (9-64 year old) with lytic lesion of the C2 vertebra and/or base of the odontoid over a 10 year period. Three patients underwent biopsy and 1 patient underwent vertebroplasty using biplane fluoroscopy. All procedures were performed under general anesthesia using a 13G needle directly introduced in the C2 vertebra through the posterior pharyngeal wall.

Results: None of the patients reported ill-effects from the procedure. Needle placement was satisfactory in all patients, without technical difficulty. No technical complication was noted. Specifically, no infectious complication occurred.

Conclusion: Our results indicate that a direct transoral approach to C2 is safe for biopsy or vertebroplasty.
– 64-year-old patient (fig. 3) treated for multiple myeloma for 2 years presenting with neck pain. Plain radiographs showed a lytic process of C2. CT confirmed the presence of extensive lysis of the C2 body with extension to the left articular mass. The patient was referred for transoral vertebroplasty of C2 for pain management and to reinforce C2 by fluoroscopy-guided injection of 2 ml of polymethylmethacrylate.

**Results**

All procedures were uneventful and free from complication. All biopsies were positive and the vertebroplasty was performed safely:

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**Fig. 1:** Transoral approach to C2. Technique: patient in supine position; oral retractor. A 13-G needle is advanced through the posterior oropharyngeal wall into the C2 body under fluoroscopic guidance.

**Fig. 2:**

CT image in a 55-year-old man with lytic lesion of C2. A transoral biopsy is performed and shows an undifferentiated carcinoma: lateral and frontal fluoroscopic images showing the position of a 13-G needle in the C2 body.
– for case 1, histology showed marrow fibrosis with mononuclear cell infiltrate suggesting chronic osteitis and bacteriology showed alpha-hemolytic streptococci. There was no suggestion of mycobacterial infection or malignancy.

– for cases 2 and 4, histology showed the presence of metastatic undifferentiated carcinoma. Bacteriology (including TB) was negative for the patient with pulmonary and renal tuberculosis (case 2).

– for case 3, vertebroplasty was successful with symptomatic relief at 24 hours and stability of lytic bone lesions at 1 year. The procedures had a mean duration time of 1 hour, and no problems occurred.

Fig. 3: 
- 64-year-old man with multiple myeloma and C2 involvement. CT shows a destructive lesion of the C2 body and odontoid process. 
- Transoral vertebroplasty: lateral fluoroscopic image showing the needle tip at the center of the C2 body and cement injection. 
- Lateral fluoroscopic image after injection of 2 ml of polymethylmethacrylate in the lytic lesion. 
- Axial and reformatted coronal CT images after vertebroplasty showing good cement distribution.
Specifically, no hemorrhagic complication or hematoma was noted. No infectious complication, such as retropharyngeal abscess, was noted. No respiratory complication was recorded. The post-biopsy follow-up was at least 6 months, and the post-vertebroplasty follow-up was 1 year.

Discussion

The approach to C2 in interventional radiology may be challenging, especially under fluoroscopy guidance. The transpedicular approach used for thoracic and lumbar vertebrae is not possible at the cervical level due to the smaller size of pedicles, and impossible at C2. An anterolateral approach is classically suggested. It is performed with slight head extension to elevate the mandible and lateral retraction of the carotid. The needle is then directed posteriorly, medially and cephalad, with the needle tip aimed at the mid C2 body. In a report on 12 patients treated with fluoroscopy-guided vertebroplasty for C2 metastasis, the authors (6) successfully used the anterolateral approach in all cases. However, this approach may be difficult, especially due to the presence of vascular and neural structures.

The transoral approach to the upper cervical spine is well known to surgeons (7), used by neurosurgeons and ENT surgeons for years. In interventional radiology, 5 case reports (1-5) described the value of this technique for biopsy or vertebroplasty. These included 4 patients, aged 58 to 76 years, treated with transoral vertebroplasty for metastases (2 cases), aneurysmal bone cyst (1 case) and myeloma (1 case). Another patient underwent biopsy of C2 for metastasis. 11-G and 13-G needles or trocars were used. Four cases were performed under fluoroscopy guidance (1-4) and the last case was performed under CT guidance (5). All authors emphasized the absence of complications, especially infectious complication. A recent publication (8) described the transoral approach for percutaneous CT guided biopsies of head and neck lesions.

We have used the transoral approach to perform C2 biopsies in 3 patients and C2 vertebroplasty in 1 patient over a 10-year period. The procedures were performed under fluoroscopy guidance because it allowed real time monitoring, especially during vertebroplasty. All procedures were performed without difficulty or complication, especially infectious complication. No hematoma, or hemorrhagic or respiratory complication was recorded. There was no case of retropharyngeal abscess or meningitis.

The transoral approach, as opposed to the anterolateral approach, was selected because it seemed to provide a more direct approach to C2, away from nerves and vessels. The transoral approach was used with the full support of our neurosurgical colleagues. The procedure was performed with patients in the supine position, with slight head extension, under general anesthesia (orotracheal intubation with inflated cuff). An oral retractor was used. The needle was advanced between tongue and uvula, towards the posterior pharyngeal wall, through the retropharyngeal space and prevertebral muscles, under fluoroscopic or CT guidance. Betadine was used for local disinfection and antibiotic prophylaxis was strongly recommended. We routinely used 13-G needles.

Normally, the posterior pharyngeal mucosa is separated from the cervical spine by a thin layer of pharyngeal constrictor and prevertebral muscles and the anterior longitudinal ligament, without interposed neurovascular structures. As such, it is the most direct approach to C2. The main risk is the potential of infectious complication. Infection was one of the first complications from the transoral surgical approach and Tong (1) reported that in 1964, 4 of 6 patients developed a pharyngeal infection after transoral C1-2 surgery, with death from meningoencephalitis in one. The same author emphasized that recent reports estimate the risk of local infectious complication following cervical spine surgery at 0-2% with a 4.5% risk of meningitis. The risk of infection from transoral cervical spine procedures in interventional radiology is lower than for surgery since the puncture site is smaller with only minimal transgression of the posterior pharyngeal wall. Also, the infectious risk is further reduced by the shorter procedure time and additional precautions used during the procedure, the use of per-os antibiotic prophylaxis, and antibiotics mixed with the cement during vertebroplasty.

The transoral approach allows needle tip placement within the C2 vertebra, under biplane fluoroscopy guidance, using a controlled more direct approach, requiring less needle manipulation with subsequent reduced risk of neurovascular or infectious complication.

Fluoroscopy guidance is generally described for transoral procedures, but CT-guided C2 vertebroplasty has been reported, with emphasis on the more precise needle placement afforded by this technique (5).

On the other hand, fluoroscopy or CT guided transoral procedures are performed under general anesthesia with orotracheal intubation in patients with potential cervical spine instability, which can be viewed as a pitfall. On the other hand, the anterolateral approach may be performed under conscious sedation (1), which is advantageous.

In conclusion, and in spite of this pitfall, we believe that the advantages of the transoral approach, allowing precise needle placement with reduced risk of neurovascular complication, may be an effective and safe alternative to the more classical approach.

References