Original article

J Nepal Health Res Counc 2019 Apr-Jun;17(43): 163-7

DOI https://doi.org/10.33314/jnhrc.v0i0.1863

Fluoroscopy Guided Percutaneous Transpedicular Biopsy of Vertebral Body Lesion

Rajesh K Chaudhary,[1] Shankar Acharya,[2] Rupinder S Chahal,[2] Kashmiri L Kalra[2]

[1]Department of Orthopaedics and Traumatology, Spine Unit, B and B Hospital/ Hospital and Rehabilitation Centre for Disabled Children (HRDC), Kathmandu, Nepal, [2]Department of Spine Surgery, Sir Ganga Ram Hospital, New Delhi-110060.

ABSTRACT

Background: The common causes of vertebral body lesion are metastasis, infection, primary malignancies or osteoporotic fractures. Histopathological examination is necessary to confirm the diagnosis. There are different approaches to collect the biopsy samples and they have different adequacy and accuracy rates and also possible complications. This study aims to determine adequacy, accuracy and safety of the fluoroscopy guided percutaneous transpedicular biopsy of the vertebral body lesion.

Methods: This is retrospective review of all the patients who underwent fluoroscopy guided percutaneous transpedicular biopsy from January 2013 to October 2016. We reviewed medical records and biopsy reports, plain radiographs, Computed Tomography Scan and Magnetic Resonance Imaging and additional necessary investigations required to confirm the diagnosis.

Results: Fifty two patients underwent fluoroscopy guided percutaneous transpedicular biopsy of vertebral body lesion in 55 different levels. Thirty six patients were male and 16 were female with mean age of 54.17 years (range 2-87 years). This procedure was performed in 55 levels from D3 to S1. The adequate sample was retrieved from 50 samples in 47 cases (90.9%). The diagnosis was confirmed by histopathological examination from 41 samples in 38 cases (82%). In three cases the histopathology was inconclusive but microbiological investigation of tissue sample confirmed the diagnosis. So in total 44 samples from 41 cases (80%), the diagnosis was confirmed by the procedure. We did not encounter any complications during the procedure.

Conclusions: Fluoroscopy guided percutaneous transpedicular biopsy is a safe minimally invasive procedure with high adequacy and accuracy rate.

Keywords: Accuracy, Adequacy, transpedicular biopsy, vertebral body lesion.

INTRODUCTION

Spinal lesions are frequently secondary to the lesions in other part of the body.[1] The common causes of vertebral body lesion are metastasis, infection, primary malignancies or osteoporotic fractures.[2] Radiological investigations and bone scan are more sensitive but less specific.[3] So biopsy is necessary for definitive diagnosis.

Open biopsy of the vertebral body lesion is considered as the gold standard.[4] But it is associated with lots of possible complications like skin, bone and soft tissue problems, risk of diagnostic error and missing a small lesions.[5] CT guided percutaneous needle biopsy via paraspinal approach is a minimally invasive procedure but as low accuracy rate and is associated with several possible complications.[6] It also increases cost and radiation exposure and does not have significant advantage over fluoroscopy.[7]

This study aims to determine adequacy, accuracy and safety of the fluoroscopy guided percutaneous transpedicular biopsy of the vertebral body lesion.

METHODS

A total of 52 fluoroscopy guided percutaneous transpedicular biopsy procedures were performed by three experienced senior spine surgeons in Sir Ganga Ram Hospital, New Delhi from January 2013 to October

Correspondence: **Rajesh K Chaudhary, Department of orthopaedics and traumatology, Spine Unit, B and B Hospital and Hospital and Rehabilitation Centre for Disabled Children Kathmandu, Nepal. Email: drraju.rajesh@gmail.com, Phone: +97715531933.**

2016. After approval from ethical committee, we reviewed medical records and biopsy reports, plain radiographs, Computed Tomography Scan (CT scan) and Magnetic Resonance Imaging (MRI) and additional necessary investigations required to confirm radiological diagnosis.

We recorded demographic data (age, gender), location of the lesion, characteristics of the lesion, anaesthesia used, biopsy report in detail and treatment provided. The biopsy report was considered inconclusive if no definitive diagnosis was established. If diagnosis was inconclusive, other additional investigations including microbiological examination was studied which helped in confirmation of the diagnosis. We also evaluated the percentage ofcrush artefacts among all the procedures performed and if this has any effect on confirmation of the diagnosis. The complications that occurred during the procedure were also recorded.

The patient's detail evaluation was done before performing the procedure. The patient was positioned prone over fluoroscopy compatible operating table. The procedure was performed under local or general anaesthesia depending upon comorbidities, patient compliance and overall anaesthetic risks. All the procedures were performed under high resolution fluoroscopy. The level planned for vertebral biopsy was marked under fluoroscopy in both anteroposterior (AP) and lateral views. In AP view, small stabincision was given and Jamshidi needle was introduced targeting superolateral edge of the pedicle after achieving so called "Bull's Eye view". Jamshidi needle was inserted further making sure that when tip was just about to touch medial wall of pedicle in AP view, it was just at the posterior wall of vertebral body in lateral view. Then the guide wire was passed. After removing the Jamshidi, working cannula was introduced through which biopsy forceps was introduced targeting the pathological area. By movement of biopsy forceps in sagittal plane, medio-lateral plane and rotation, more area of vertebral body was reached (Figure 1).

When adequate sample was retrieved, it was sent for histopathological and microbiological investigations. Those cases whose biopsy report was inconclusive, other additional investigations including microbiologic examinations were reviewed.

The available data was analysed to determine adequacy, accuracy and safety of the procedure and was compared with the available literatures.

Conclusive Diagnosis: Definitive diagnosis established in tissuehistopathological and microbiology report

Inconclusive Diagnosis: Definitive diagnosis was not established in tissuehistopathological and microbiology report

Adequacy Rate (%): The total number of adequate samples retrieved divided by the total number of samples collected X 100

Accuracy Rate (%): The total number of conclusive diagnosis divided by total number of adequate samples X 100

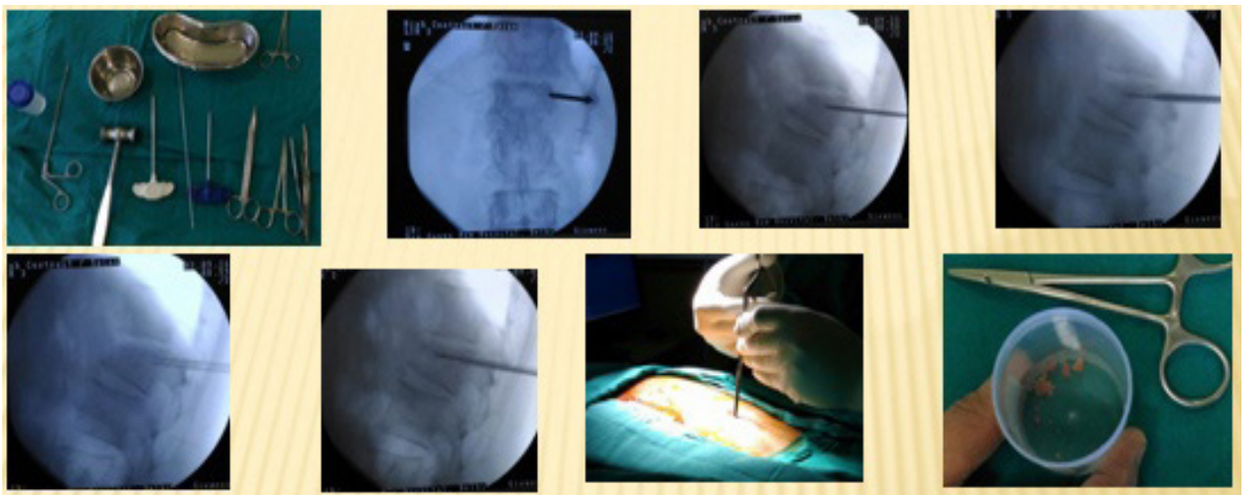

Figure 1. Instruments and Technique of Fluoroscopy Guided Percutaneous Transpedicular Biopsy of Vertebral Body Lesion.

RESULTS

Fifty two patients underwent fluoroscopy guided percutaneous transpedicular biopsy of vertebral body lesion in different levels. Thirty six patients were male and 16 were female with male: female ratio of 9:4. The mean age of the patient was 54.17 years (range 2-87 years).

This procedure was performed in 55 levels in 52 patients from D3 to S1 level. The samples collected from three common levels were10 samples from L4 vertebral level, eight samples from D12 and seven samples from L2. Forty two cases (80.76%) were done under general anaesthesia and 10 cases (19.23%) in Local anaesthesia.

The adequate sample was retrieved in 50 samples from 47 cases(90.9%). One case was reported as inadequate sample in histopathology report but was positive for Mycobacterium Tuberculosis in Rapid AFB culture. The diagnosis was confirmed by histopathological examination only 41 samples from 38 cases (82%). In three cases the histopathology was inconclusive but microbiological investigation of tissue sample confirmed the diagnosis. So, in total 44 samples from 41 cases (88%), the diagnosis was confirmed by the procedure.

Fifteen cases (28.84%) were diagnosed as infection, 14 cases (26.92%) as fracture and 11 cases (21.15%) as malignancy and 1 case (1.92%) as eosinophillic granuloma. Out of 15 cases of infection, 10 cases were tubercular, three cases were acute pyogenic and two were chronic spondylitis. Among 10 cases of tubercular spondylitis, seven cases were diagnosed by positive histopathological examination and three cases were not conclusive in histopathological examination but rapid AFB culture showed growth of *Mycobacterium Tuberculosis*. Three cases were acute pyogenic spondylitis with growth of *Staphylococcus aureus*, *E. coli* and *Proteus Mirabilis*. Two cases were chronic ostemyelitis but no growth in microbiological examination. Out of 11 cases of malignancy, five cases were primary malignancy (three cases plasma cell tumour, one case B cell Non-Hodgkin's Lymphoma) and six cases were metastatic carcinoma. 1 case was of eosiophillic granuloma.

Eleven cases (21.15%) were inconclusive which were due to inadequate sample in two cases, inadequate sample and severe crushing of the tissue in one case and only severe crushing in one case. In seven cases, diagnosis was inconclusive although sample was adequate and there was no crushing of the sample. Although histopathological and microbiological examination did not confirm diagnosis, two cases were treated empirically with antitubercular chemotherapy.

In eight cases, histopathological evaluation showed crushing of the sample tissue. So overall rate of crushing was 14.54% but even in presence of crush artefact, diagnosis was confirmed in six cases (two cases of osteoporotic fracture, one case of B-cell lymphoma and three cases of pyogenic infection). Out of eight cases of crush artefact, two cases were inconclusive (one case due to severe crush artefact and another case due to inadequate sample and severe crush artefact).

DISCUSSION

Percutaneous biopsy of the vertebral body can be performed via posterolateral and transpedicular route. The indications for using posterolateral or transpedicular biopsy depends on the location of the lesion.[8] The lesion involving the vertebral body is the best indication for transpedicular biopsy.[7,8] Layton et al showed that transpedicular route can be used to take biopsy from disc space and both adjacent vertebral endplates by modified vertebroplasty approach which can be utilized for biopsy of suspected discitis/spondylodiscitis.[9] In one case, we performed the procedure from D8-D9 disc space which was diagnosed as pyogenic spondylodiscitis and *E. Coli* was grown in routine culture and sensitivity of the tissue sample.

Renfrew et al recommended CT guided transpedicular biopsy of vertebral body lesion.[10] But it does not provide real time imaging, increases radiation exposure to the patient and physician, increases cost, and are not readily available in all centres.[11] There are several advantages of fluoroscopy guided procedure over CT guided procedure. The fluoroscopy guided procedure is less expensive, usually performed in operation theatre and if any possible complications arise, they can be managed immediately.[12] Nourbakhsh et al reported CT scan slightly superior to fluoroscopy for percutaneous vertebral biopsy regarding adequacy (92.6% in CT scanVs 90.1% in fluoroscopy), accuracy (90.2% in CT scan Vs 88.1% in fluoroscopy) and complications (3.3% in CT scan vs 5.3% in fluoroscopy) but they were not statistically significant.[7] We used high resolution fluoroscopy in all the cases and did not encounter any difficulties in locating lesion and performing the procedure.

According to Zindrick et al the average transverse outer diameter of pedicle isthmus in T5 vertebra is five mm; which has narrowest pedicle and L5 vertebra has 18mm.[13] So transpedicular biopsy can be performed from all the thoracic, lumbar and sacral vertebra using the biopsy trocar or forceps of at least three mm diameter.

In our study, the procedure was performed from D3 to S1 level. In one case, it was performed in twoyears old girl with vertebra plana of L1 vertebra. She was diagnosed as eosinophilic granuloma by histopathological examination.

This procedure can be performed under local anaesthesia or general anaesthesia depending upon patient compliance, comorbidities and anaesthetic risks. Dave et al performed the procedure under local anaesthesia in all the cases.[3] The most important advantage of local anaesthesia is immediate recognition of inadvertent neural injury during the procedure.[14] The local anaesthesia and an outpatient setting increases the cost effectiveness. We performed 42 cases under general anaesthesia. We prefer general anaesthesia because it provides better pain control during the procedure and also increases patient compliance.

Several instruments can be used to retrieve biopsy samples. Whatever instruments are used, the adequate bone sample with minimal crushing effect should be the target.[11] In cases of infection and metastasis, small diameter biopsy cannula can be used but in sclerotic lesion larger diameter is required.[15] In a cadaveric study, Fife et al reported increase in the biopsy diameter more than twomm increased the diagnostic yield of the specimen from 59% to 90%.[16] In sclerotic lesions also the use of core biopsy is advocated by Ghelman et al rather than spinal needles.[2]Besides needle and trocar, another instrument that can be used is biopsy forceps, arthroscopic punch or grasper. Shrestha et al has mentioned that the arthroscopic punch, grasper or biopsy forceps give rise to crush artefacts in histopathological examination.[11] In our study, we used biopsy forceps in all the cases. The crush artefact was found in eight samples (14.54%) but only two cases were inconclusive. Only one case was inconclusive due to severe crush artefact.

The adequacy of the biopsy sample depends upon characteristics of the lesion, instruments used, technical skill. Kim BJ et al reported 97.1% adequate sampling by fluoroscopy guided transpedicular biopsy.[17] Dave et al[3] and Shrestha et al[11] obtained adequate samples in all cases where as Mukharjee et al[18] performed 184 biopsies in 135 patients and only 78% were adequate diagnostic specimen.Strokeret al[19] found lower adequacy rate in sclerotic lesions. Adequacy rate in our study is 90.9%. In five cases, the sample was inadequate. In one case, sample was inadequate to comment in histopathological examination but the microbiological evaluation of the tissue sample showed growth of *Mycobacterum Tuberculosis* in Rapid AFB culture.

The vertebral body lesions are usually due to infection, metastasis, primary tumour and osteoporosis. Dave et al performed the procedure in 71 cases and established diagnosis in 63 cases. The pathological examination revealed infection in 25 cases, osteoporotic wedging in 21, metastasis in eight, plasmacytoma in three, multiple myeloma in four, non-Hodgkin's lymphoma in one and roundcell tumour in one patient.[3] In study by Moller G et al, out of 32 cases infection was present in nine cases, metastasis inseven cases, five had primary tumour and three had osteoporosis.[15]In our study, the common diagnoses confirmed were infection, malignancy and osteoporotic fracture. Tuberculosis is very common in our part of world but in our study the number of malignancy and tuberculosis is almost same. This is because in most of the cases of tuberculosis, patients present with instability or neurological deficit so decompression and instrumentation is performed and many cases are treated empirically. Few patients undergo transpedicular biopsy before starting antitubercular chemotherapy but in most of the suspected cases of malignancy, biopsy is performed.Common primary malignant pathologies were plasma cell tumour, B-Cell non-Hodgkin's Lymphoma.

Overall accuracy of spine biopsy ranges from 16% to 98%.[20] The characteristics of the lesion is one of the major factors, besides type of instrument used which determines the accuracy of the fluoroscopy guided transpedicular biopsy. Metastatic lesions provide the highest accuracy rate.[21] Lytic and mixed lytic lesions, compression fractures and inflammatory bone lesions have the highest accuracy rate(93%).[22] The sclerotic lesions have lower accuracy rate(76%).[12] There are different studies which shows accuracy rate of fluoroscopy guided transpedicular biopsy ranging from 69.1% to 94.36%.[3,14,23] In our study, 41 samples from 50 adequate samples (82%) were diagnosed by histopathological examination only and three more cases who had inconclusive histopathological examination were positive in microbiological examination. So 44 samples out of 55total samples (80%), diagnosis was confirmed by both histopathological and microbiological examination. This signifies the importance of microbiological examination along with histopathological examination in all the cases.

Potential complications of percutaneous transpedicular biopsy include pneumothorax, hematoma, nerve root injury, transient paresis and sinus tract formation. Several studies have established the safety of this procedure. Study by Syed et al[14], Dave at al[3] had no complications. In study by Moller et al, hematoma developed in two cases out of 34 biopsies in 32 patients.[15]

Pierotet al in their study concluded that transpedicular approach avoids the pulmonary complications without increasing the rate of neurologic complications.[8] We did not encounter any complications during the procedure.

CONCLUSIONS

Fluoroscopy guided percutaneous transpedicular biopsy is a safe minimally invasive procedure with high adequacy and accuracy rate in diagnosis of the vertebral body lesion and can be performed under local anaesthesia with minimal risk of complications.

REFERENCES

1. Odendaal T, Lemmer LB. The Value of percutaneous trephine biopsy in the diagnosis of lesions of the vertebral column. S Afr Med J. 1991;79:21-23.[FullTextLink]
2. Ghelman B, Lospinuso MF, Levine DB, O'Leary PF, Burke SW. Percutaneous computed tomography guided biopsy of the thoracic and lumbar spine. Spine. 1991; 16:736-9. [Link]
3. Dave BR, Nanda A, Anandjiwala JV. Transpedicular percutaneous biopsy of vertebral body lesions: a series of 71 cases. Spinal Cord. 2009; 47:384–9. [FullTextLink]
4. Dupuy DE, Rosenberg AE, Punyaratabandhu T, Tan MH, Mankin HJ. Accuracy of CT-guided needle biopsy of musculoskeletal neoplasms. Am J Roentgenol. 1998;171:759-62.[Link]
5. Mankin HJ, Lange TA, Spanier SS. The hazards of biopsy in patients with malignant primary bone and soft-tissue tumors. J Bone Joint Surg Am. 1982;64:1121-7.[DOI]
6. Jelinek JS, Kransdorf MJ, Gray R, Aboulafia AJ, Malawer MM. Percutaneoustranspedicular biopsy of vertebral body lesions. Spine. 1996;21:2035-2040.[Link]
7. Nourbakhsh A, Grady JJ, Garges KJ. Percutaneous spine biopsy: A meta-analysis. J Bone Joint Surg Am. 2008; 90:1722-5.[Link]
8. Pierot L, Boulin A. Percutaneous biopsy of the thoracic and lumbar spine: transpedicular approach under fluoroscopic guidance. Am J Neuroradiol. 1999;20:23-25.[Link]
9. Layton KF, Thielen KR, Wald JT. A modified vertebroplasty approach for spine biopsies. Am J Neuroradiol. 2006;27:596-597.[Link]
10. Renfrew DL, Whitten CG, Wiese JA, el- Khoury GY, Harris KG. CT-guided percutaneous transpedicular biopsy of the spine. Radiology. 1991; 180:574-6.[DOI]
11. Shrestha D, Shrestha R, Dhoju D. Fluoroscopy Guided Percutaneous Transpedicular Biopsy for Thoracic and Lumbar Vertebral Body Lesion: Technique and Safety in 23 Consecutive Cases. Kathmandu Univ Med J. 2015;51(3):256-60. [DOI]
12. Nourbakhsh A. Percutaneous Spine Biopsy: A Literature Review. Int J Radiol Radiat Oncol. 2015;1(1): 023-028. [Link]
13. Hadjipavlou AG, Kontakis GM, Gaitanis I, Tzermiadianos M. Diagnostic and therapeutic percutaneous transpedicular approaches to the spine. In: ParvizKambin, editor. Arthroscopic and Endoscopic Spinal Surgery. 2nd Ed. New Jersey: Humana Press. 2005; 167-204.[Link]
14. Syed Imran Bukhari. Efficacy of Percutaneous Transpedicular Needle Biopsy in Vertebral Pathologies under Fluoroscopic Guidance. Journal of Pakistan Orthopedic Association. 2014;26 (1):1-6.[Link]
15. Moller S, Kothe R, Wiesner L, Werner M, Ruther W, Delling G. Fluoroscopy-guided transpedicular trocar biopsy of the spine—results, review and technical notes. Acta Orthop Belg. 2001; 67(5): 488- 99.[FullText]
16. Fyfe IS, Henry AP, Mulholland RC. Closed vertebral biopsy. J Bone Joint Surg Br. 1983;65:140-3.[DOI]
17. Kim BJ, Lee JW, Kim SJ, Lee GY, Kang HS. DiagnosticYield of Fluoroscopy-Guided Biopsy for Infectious spondylitis. Am J Neuroradiol. 2013;34:233-8.[DOI]
18. Mukherjee S, Thakur B, Bhagawati D, et al. Utility of routine biopsy at vertebroplasty in the management of vertebral compression fractures: a tertiary center experience. J Neurosurg Spine. 2014; 21:687-97.[DOI]
19. Stoker DJ, Kissin CM. Percutaneous vertebral biopsy: a review of 135 cases.ClinRadiol. 1985;36:569-77.[DOI]
20. Metzger CS, Johnson DW, Donaldson WF 3rd. Percutaneous biopsy in the anterior thoracic spine. Spine. 1993;18:374-8.[Link]
21. Kattapuram SV, Khurana JS, Rosenthal DI. Percutaneous needle biopsy of the spine. Spine (Phila Pa 1976). 1992;17: 561-564.
22. Jacobsson H. Percutaneous bone biopsy with a simple punch instrument. Indications, results and complications. Acta Radiol Diagn. 1982;23: 415-422.[DOI]
23. Hadjipavlou AG, Kontakis GM, Gaitanis JN, Katonis PG, Lander P, Crow WN. Effectiveness and pitfalls of percutaneous transpedicle biopsy of the spine. Clin Orthop Relat Res. 2003; 411:54-60. [Link]