ROLE OF COMPUTED TOMOGRAPHY IN DETECTION OF LUMBAR DISC PROLAPSE

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ABSTRACT

Objective: To determine the sensitivity of CT scan in diagnosing lumbar disc prolapse.

Study Design: Validation study

Place And Duration Of Study: Combined Military Hospital Multan. From August 2009 to July 2010.

Patients and Methods: Patients with clinical suspicion of lumbar disc prolapse were referred from Neurosurgical OPD for CT scan of lumbar spine. The target CT finding was disc prolapse with compression of dural sac or narrowing of lateral recess / neuroforamina. Patients were divided into positive and negative cases on basis of detection of target finding by CT. All positive cases underwent surgery. Negative cases were first treated conservatively and only patients with persistent symptoms underwent surgery. The findings of CT as index test were compared with operative findings as gold reference standard.

Results: Total 61 cases were included in study, 51 positive cases and 10 negative cases. Mean age of patients was 44.6years. There were 42 males and 19 females. Positive cases after surgery showed 48 true positive and 03 false positive cases. Two negative cases showed persistent symptoms, underwent surgery and found positive for target finding (false negatives. Eight negative cases became symptom free after conservative treatment. These CT negative cases turning asymptomatic were ethically not feasible for surgery so assumed as true negative. The above data of 61 cases was computed in 2x2 table to calculate sensitivity (96%) and positive predictive value (94%) of CT scan in diagnosing lumber disc prolapse.

Conclusion: CT scan is having high sensitivity and positive predictive value in detecting lumber disc prolapse. It is reliable imaging modality in this regard.

Keywords: Computed tomography, Low back pain, Lumbar disc prolapse.

INTRODUCTION

Low back pain is common problem in day to day clinical practice. Patients are seen roaming in hospitals in search of correct diagnosis. Low back pain is second most common health complaint after sore throat. Majority (80-90%) of population experience low back pain at anytime in their life[1,2]. It causes substantial economic burden in western societies[3,4]. One of the common causes of low back pain is lumbar disc prolapse. In imaging of lumbar disc prolapse, Computed tomography (CT) scan is conventionally thought to be having no significant role. CT is even kept below myelography in list of investigation in our country. Magnetic resonance imaging (MRI) is thought to be the only imaging solution of lumbar disc prolapse problem not giving CT its due position.

MRI is not widely available in our country as compared to CT especially in Armed Forces. MRI is more costly, having long waiting list and time taking procedure. There is also a group of non-compatible patients to MRI like elderly with cardiac pacemaker and claustrophobics. MRI is also more problematic in postoperative spine than CT due to metallic artifacts[5]. Myelography is an interventional procedure and also carries a little risk requiring brief hospital stay. Moreover considering cost of contrast and procedure of myelography, CT is cheaper. CT is widely available, non-invasive and patient friendly. It gives information not only about disc prolapse but also about bony canal, neuroformina, facets joints and paravertebral tissues as compared to myelography. There is no additional advantage of CT myelography over simple CT[5].

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The purpose of this study is to highlight the fact that plain CT scan with good standard scanning protocol can efficiently detect lumbar disc prolapse with neuronal compression . In our study, CT findings as index test are compared with surgical findings as gold standard.

PATIENTS AND METHODS

The study was carried out in Radiology department of CMH Multan, a 500 bedded tertiary care hospital, from Aug 2009 to July 2010 in collaboration with Neurosurgical department. The Radiology department is equipped with Toshiba Asteon 4 slice spiral CT scanner. MRI was not available in the hospital at the time. Patients having clinical suspicion of lumbar disc prolapse with neuronal compression or reticulopathy were referred from neurosurgery OPD for CT scan. Patient's bio-data as age, sex, clinical finding of neurosurgeon and duration of symptoms were recorded on a register by our staff. Formal consent was taken before scanning. Patients between 30 to 55 years were included in study. Patients having previous history of lumbar spine surgery were excluded.

Patients were scanned in supine position. Lateral and anteroposterior scout scans were done first. Scanning parameters included 120 KV and 300 mA. Contiguous slices of 02 mm were taken in straight axial fashion from lower half of body of L3 to S1 segment. All images were studied after appropriate magnification in both bone and soft tissue windows. Disc lesions are better seen in soft tissues window. Disc prolapse beyond vertebral end plate with either compression of dural sac or with narrowing of lateral recess or neurofomina was regarded as positive test (the target finding). Other additional findings if present were also noted. Imaging findings were recorded on the register and later compared with operative findings (the reference gold standard).

All cases were discussed with neurosurgeon periodically. The operative findings of patients having undergone surgery were also noted. Patients were divided in positive and negative cases. Positive cases included patients positive for target finding and negative cases included patients having normal or inconclusive study. All positive cases underwent surgery. Negative cases were treated conservatively first and only patients with persistent complaints underwent surgery. At the end of study period, collected data was computed in 2x2 table and effectiveness of CT examination in detecting lumbar disc prolapse was determined by calculating sensitivity and positive predictive values.

RESULTS

A total of 61 patients were included in the study. Their mean age was 44.6 years (SD=4.6). Among them 42 were male (68.85%) and 19 were female (31.19%). Male to female ratio was 2.2:1. All patients were either serving /retired persons of Armed Forces or their dependents. Positive cases were 51 (83.6%) and negative cases were 10 (16.39%). Different varieties of disc prolapse were noted. Twenty one cases of broad based disc prolapse (41.1%), 12 cases of focal disc prolapse (23.5%), 10 cases of both broad based and focal disc prolapse (19.6%), 6 cases of free disc fragment (11.7%) and 2 cases of lateral disc prolapse (3.9%) were noted. All positive cases underwent surgery. Negative cases were first treated conservatively. Eight negative cases became symptoms free after conservative treatment. Two negative cases with persistent symptoms and with strong clinical suspicion were operated. So 53 cases finally underwent surgery, 51 positive cases and 02 negative cases.

On the basis of operative findings, among positive CT cases, 48 patients were noted having disc protrusion with neural compression as per finding of CT (true positive) and 03 cases were not in agreement with positive CT finding (false positive). In later cases, findings noted were intraspinal neurofibroma, bulging annulus and Tarlov's cyst. Two CT negative cases were noted having lumber disc prolapse on surgical finding (false negative). On retrospective reviewing of above results, it was noted that extreme obesity and advanced lumbar degenerative disease were

probably responsible for difference of finding between CT and surgery.

Eight CT negative cases, turning asymptomatic after conservative treatment, were ethically not feasible for surgery so assumed as true negatives. The above mentioned results of 61 cases were computed in 2x2 table to calculate sensitivity and positive predictive value (PPV) of CT scan in detecting lumber disc prolapse. The sensitivity was 96% and PPV was 94.1%.

DISCUSSION

We felt that CT of lumbar spine is rated low, even below myelography, for its ability in providing imaging details for detecting lumbar disc prolapse with neuronal compression .This thing provoked us for this study. CT scan can help neurosurgeon to take operative decision where MRI is not easily available or affordable. It is better to take operative decision early rather than postponing patients or referring them to other cities[6]. Although there is a little radiation risk with CT but timely management decision can be done which at time is priceless since delayed diagnosis and treatment is associated with poorer outcomes[6]. CT is non invasive, quick, cheap and relatively more available modality. There is no place for simple myelography now. Even CT myelography does not have additional imaging advantage over simple CT[5]. The studies have shown that Spiral CT can give as good information as MRI in diagnosing lumbar disc prolapse[7].

Scanning protocol in CT lumbar spine is very important. Continuous axial slice scanning should start from midbody of L3 to S1 as 10% prolapse occurs at L3 - L4 disc level 5. The early protocol of scanning disc with angled gantry is not recommended now as it can miss free fragments in between disc levels 5. Scans should be viewed in soft tissue and bone windows. The disc appears hyperdense in soft tissue window and is easily recognized. A prolapsed disc means that it is bulging beyond the margins of endplate of related vertebra. Lumbar disc prolapse can be divided under four categories i.e. broad based prolapse, focal disc prolapse, free fragment or lateral disc prolapse[5].

If a broad based or focal disc prolapse does not impress upon dural sac or nerve root it cannot be seen on myelogram. These can be

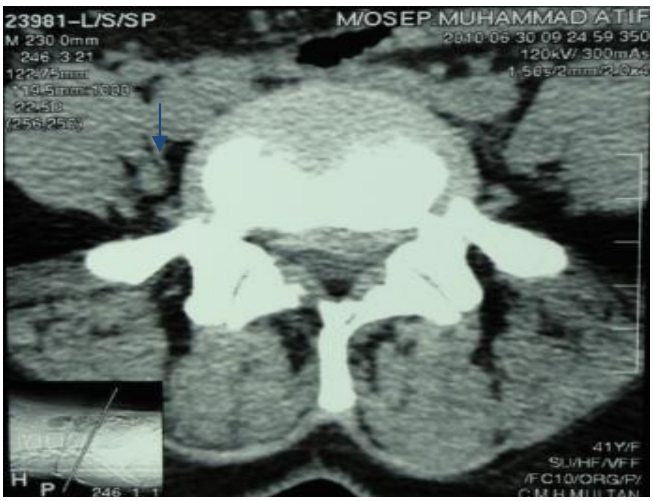

Figure-1: Prolapsed disc can be seen compressing dural sac.

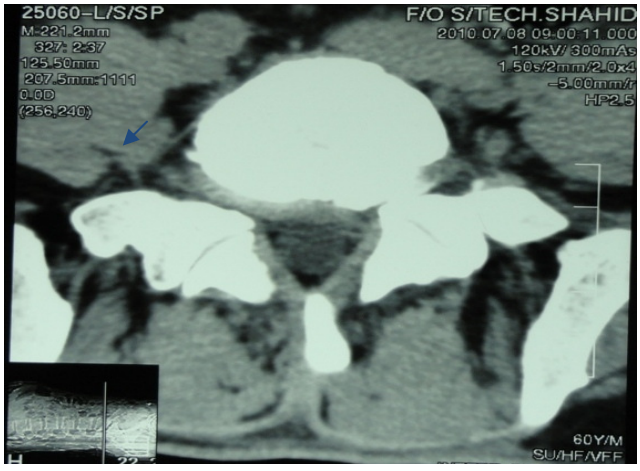

Figure-2: Prolapsed disc can be seen causing narrowing of right neuroforamen.

viewed on CT scan. They may not be symptomatic but may cause problems in future. There are 43 cases of broad based disc and focal disc prolapse in our study (Figure–1 and 2).

Free fragment should always be suspected whenever there is large disc prolapse and disc material should be searched above or below the disc level. This free fragment can be recognized

as being hyperdense than dural sac. It should be differentiated from Tarlov's cyst and conjoint nerve root as both are isodense to dural sac. Faulty diagnosis of conjoint nerve root as free fragment may result in failed surgical procedure[8].

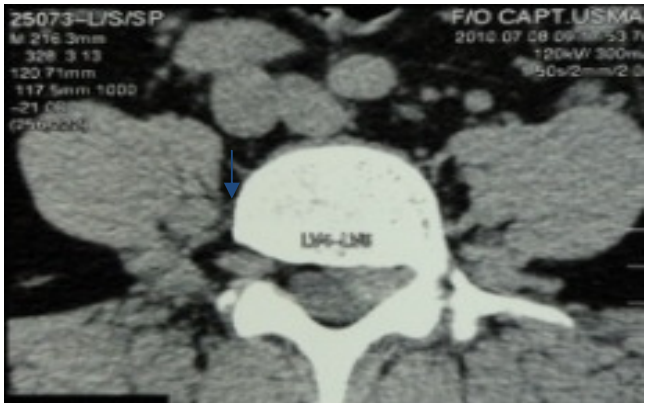

Figure-3: Showing a free segment in left lateral recess.

The free fragment is one of the causes of failure of percutaneous discectomy or microdiscectomy surgical procedures[5]. Solitary free segment is noted in six cases in our study (Figure-3).

A lateral disc prolapse is the prolapsed disc lateral to the neuroforamen. Its frequency is less than 5% but has great clinical significance in two ways. First, it can easily be overlooked, being lateral to neuroforamen. Second, it can compress the already exited nerve root so clinically mimics disc prolapse at a higher level and may result in failed back surgery. When it is carefully picked up on CT[9], it will make surgery easy as can be approached from outside the spinal canal. The lateral disc prolapse cannot be picked up on myelography[5]. Lateral disc prolapse is noted in two cases in our study.

In our study we highlighted the well deserved role of CT in detecting prolapsed lumbar disc with neural compression. The sensitivity (96%) and PPV (94.1%) are very encouraging to highlight its ability in detecting prolapsed lumber disc. We found that extreme obesity and advanced lumber degenerative disease may limit CT detection of prolapsed lumber disc in few cases. It is in accordance with previous international studies. In a study by Firooznia et al in Germany, the sensitivity of CT 92% was detected for prolapsed lumbar disc[10]. These results are closer to our study. Similar studies of Forristall et al showed CT sensitivity of 83%[11], by Jackson et al the sensitivity 71%[12] and Thornbury et al published a study showing sensitivity 94%[13]. A review study for accuracy of CT in herniated nucleus pulposus was done by Rogier et al and was published in 2012 compared seven different studies from 1984 to 1994 which collectively showed sensitivity of 77.4%[14]. The sensitivity in later study is comparatively less than ours. The reason may be that all studies in above mentioned review study were performed with old versions of CT and with slice thickness mostly of 05 mm (vs. 02 mm in our study). With best of our knowledge we did not find any study in our country on this topic.

CONCLUSION

The CT scan efficiently detects prolapsed lumbar disc as having high sensitivity and positive predictive value in this regard. It may show some limitations in extreme obesity and advanced lumber degenerative disease. However, it should be chosen confidently to solve the clinical query of prolapsed lumbar disc rather than delaying diagnosis and surgical management when it is the only available modality for this purpose.

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