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Can discoblock replace discography for identifying painful degenerated discs?

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ABSTRACT

Objectives: The aim of the present study was to intra-individually compare provocative discography and discoblock (disc analgesia) of idiopathic degenerated discs (IDD) results to each other, to clinical parameters, and to MRI findings. By this the value of both diagnostic features should be critically reevaluated.
Methods: 31 intervertebral IDD (Pfirrmann III°–IV°) of 26 patients were analyzed for surgery decision making by combined discoblock/discography procedure in an open MRI at 1 T. A correlation analysis was performed between the Dallas Discogram Scale, pain discrimination score (PDS: concordant/discordant/no pain), positive discoblock (Numerical Rating Scale [NRS] reduction by ≥3, 60 min after intervention), presence of Modic changes or high intensity zones (HIZ), patient sex and age, intervention level, injection pressure and discography endpoint analysis (pain/pressure/anatomic/volume).
Results: Concordant pain could be evoked in 35% of the IDDs whereas discoblock was positive in 64%. Patients' age, sex, Dallas I, Dallas II, and Pfirrmann scores, as well as the presence of HIZ did not correlate to PDS or discoblock results. Discoblock correlated positively to concordant pain. Further positive correlation was found between PDS and intervention level/pressure, between discoblock and Modic changes/discography endpoint as well as between HIZ and discography endpoint.
Conclusions: We suggest discoblock to be an additional tool for surgery decision making in patients with IDD because it correlates to concordant pain evoked by provocative discography as well as to presence of Modic changes. Additionally, assessment of a release instead of provocation of pain can be of advantage.

1. Introduction

Low back pain (LBP) is a frequent clinical symptom causing relevant costs for the healthcare system. Besides pathology of the facet joints, the muscular fascia, the sacroiliac joint, and the spinal ligaments, idiopathic degeneration of the intervertebral disc (IDD) has been attributed to LBP in 26–39% of the cases [1]. For a spinal surgeon it is essential to exclude patients with reasons for low back pain other than addressable by the planned surgical treatment. This can lead to lower clinical failure rates and therefore possibly increases clinical success rates [2].

To detect IDD, magnetic resonance imaging (MRI) was frequently used but MRI alone seems not to be able to discriminate a painful from an asymptomatic degenerated disc [3,4]. To localize or confirm discogenic pain, provocative discography in fluoroscopy or computed tomography (CT) was suggested [5,6]. However, discography is controversially debated in literature because of its possible lack of reliability, validity and its radiation exposure [5,7].

Radiation exposure can be reduced or avoided by a low-dose CT based discography and MRI discography [5]. Most recently, the feasibility of an open-field 1 T MRI (oMRI) in the guidance of discography was reported. The oMRI combines the advantages of multiplanar navigation capabilities and high-quality diagnostic information [8]. To increase reliability, pressure and volume controlled discography was established by Derby et al. [9]. Nevertheless, for a test method to be valid, one requirement is a low rate of false-positive responses in comparison to a standard test criterion [10]. This facility is not available for discography, since discography itself is the only available method for evaluating discogenic pain [6,9,11]. To date, the rate of false-positive results was based on discographic findings of asymptomatic individuals or

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surgical success of individuals with concordant pain reproduction in preoperative discography [2,9,12]. Discoblock (slowly disc injection of a small amount of a local anaesthetic drug) was recently suggested by Ohtori et al. as an alternative procedure to identify patients with symptomatic IDD [12]. The use of discoblock resulted in a higher clinical success after fusion surgery compared to patient selection by discography. Alamin et al. recently evaluated discoblock in patients who reported concordant pain in discography or in patients who were highly suspicious for DDD as pain source by evaluation of MRI-pictures [13]. They found about 46% of the tests to be in disagreement and correlation of discoblock to Modic grade 1 in MRI and suggested to use discoblock to possibly further rule out false positive discography results. However, to the authors' knowledge, an intra-individual comparison by combination of discography and discoblock was not reported in the literature.

The aim of the current study was to evaluate the feasibility of discoblock and to compare the intra-patient response to simultaneously performed provocation discography and discoblock. Additionally, a correlation analysis should be performed regarding the results of both procedures and MR-morphological changes of the examined lumbar discs. Beside this, critical evaluation of the concordant pain in discography and a successful discoblock as diagnostic procedures for identifying IDD as a cause for low back pain should be performed. Hypothesis was a better discrimination of painful versus not painful IDD by discoblock compared to discography.

2. Material and methods

2.1. Study design

Patients with persistent low back pain, unsuccessful conservative treatment, covering a period of at least six months, and preceding MR imaging were included prospectively in this study. All included disc segments presented single- or two-level degenerative disc disease (DDD) Pfirrmann grade III° or IV° with or without Modic changes of the adjacent vertebral endplates grade ≤II° and with or without high intensity zones (HIZ: focal high-intensity signal approaching the brightness of the adjacent cerebrospinal fluid, located in the posterior annulus in T2-sequences) in L3/4, L4/5, or L5/S1 in MRI. Patients with leg pain, patients who had undergone previous spine surgery in the segment to evaluate, or patients with multisegmental disc degeneration of more than two segments, patients with spondylolisthesis, scoliosis, malignant tumours, or other severe kidney and liver diseases were excluded. Additionally, patients with an infection, immunosuppression, allergy to local anaesthetics, contrast media, iodine, a Body-Mass-Index (BMI) > 30, pregnancy, chronic nicotine, alcohol or drug abuse and patients with chronic pain ≥ stage II according to Gerbershagen [14] were not included in this study.

The conduct of this study was approved by the local ethics committee. Subjects were informed of the nature of the study and the risks of discography and discoblock before consenting to participate.

2.2. Interventional procedure

Intervention was performed in an open MRI suite under aseptic conditions by one discographer, who respectively had long-time experience with the procedure. In cases where two levels had to be evaluated, procedure was done on different days. Subjects were monitored with pulse oxymetry and a blood measure cuff. In lateral position, patients were placed in open high-field MRI 1.0 T (Panorama HFO, Philips, Best, Netherlands). First, employing a flexible single-loop surface coil, a localizing sequence in three planes of motion was acquired. Following this, an anatomic scout for evaluation and graduation of DDD was generated using T1 and T2 weighed Turbo-Spin-Echo (TSE) sequences in sagittal and transversal planes. After local anaesthesia of the skin (5 ml 1.0% lidocaine), using a posterolateral approach, a 20-gauge MR-compatible Chiba-type needle (MReye™, Cook, Bloomington, IN, USA) was placed into the disc centre under real time MRI navigation employing an interactive proton density (PD) weighted TSE sequence in parasagittal and paratransversal planes. During real time MRI, a maximal volume of 2 ml of a mixture (600:1) of a long-acting local anaesthetic (Carbostesin™ 0.5%; AstraZeneca, Germany) and gadolinium based contrast medium (Gadovist™, Bayer Schering, Berlin, Germany) was injected into the nucleus of each disc. Discography procedure and MR discogram after intervention was saved into PACS for analysis.

Table 1
Adapted Dallas Discogram Scale [30].

Dallas I (annulus degeneration)	Dallas II (annulus rupture)	Pain discrimination score quality of pain
0 No change	0 None	0 No pain
1 Local (<10%)	1 Into inner annulus	1 Painful discordant
2 Partial (<50%)	2 Into outer annulus	2 Painful concordant
3 Total (>50%)	3 Beyond outer annulus	

MR discograms were acquired employing fat-saturated T1-weighed TSE sequences in transversal and sagittal planes. The discograms were analyzed according to the Dallas Discogram Scale (Table 1) regarding the grade of annulus degeneration (Dallas I) and grade of disruption of the annulus (Dallas II) [15].

2.3. Intra- and post-interventional examination procedure

At the time of injection, each subject was awake, alert, and able to respond to instructions and questions. Directly after injection, subjects were asked to report the quality of evoked pain according the Dallas Discogram Scale (concordant, painful discordant, or not painful) [8]. Based on the International Association for the Study of Pain (IASP) guidelines, pain provocation was judged to be positive when a Numerical Rating scale for pain (NRS, 0–no pain, 10 maximum pain) of ≥7/10 was reached [6].

Since no MRI-pressure measurement syringe was available, pressure control had to be performed manually by describing the elastic resistance during contrast application together with registration of the volume of contrast agent applied. Injection was stopped when

(a) the patient reported a concordant pain (pain endpoint),
(b) the manually registered elastic resistance increased fast and markedly (pressure endpoint),
(c) 2.0 ml contrast agent was applied without provoking (a) or (b).

In concordance with the literature [7,9], the group of patients with endpoint (c) were divided into two further groups depending on whether a contrast agent leak out through the annulus was registered in discogram (anatomic endpoint) or not (volume endpoint).

To evaluate discoblock, patients were asked for a significant release from their familiar pre-interventional pain (NRS change ≥3/10 compared to the pre-interventional state) 60 min after intervention.

2.4. Correlation analysis

Correlation analysis was performed between pain discrimination score/discoblock evaluation and patient's sex, age