Patient Outcomes Following the Use of Methylprednisolone Acetate 40mg Particulate Steroid Versus Dexamethasone 3.3m/6.6mg Non-Particulate Steroid in Foraminal Epidural Injections for the Management of Radicular Pain due to Disc Prolapse

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ABSTRACT

Aims/Objective: To compare the outcomes of using methylprednisolone acetate (MPA) 40mg particulate steroid and dexamethasone (DXM) 3.3/6.6mg non-particulate steroid in primary transforaminal epidural steroid injections (TfESIs) for radicular pain due to lumbar disc prolapse.
Study Design: Retrospective review of prospective collected data.
Patient Sample: A total of 95 patients that, between 11/01/13 - 06/04/18, had received a primary epidural injection due to a disc prolapse in the lumbar or sacral region.
Method: Using the Bluespier operative database, all patients that received a TfESI between 11/01/13-06/04/18 were identified. Repeat patients were removed. Patients were categorised into two groups depending on whether they received a TfESI containing MPA or DXM. Images of patient's spinal pathologies were found on IMPAX, those with a disc prolapse were kept in the study; patients with other pathologies were removed. We used Clinical Portal to look at the patients' pre- and post-TfESI pain scores (VAS and back/leg) and disability scores (ODI), these were statistically analysed and compared.
Results: 695 patients were identified on Bluespier database, with 95 patients meeting the criteria and being included in the study. 68/95 patients received MPA, and 27/95 patients received DXM. Of the 95 patients, 54 were male and 41 female. There was no significant difference in patient groups when looking at gender (p=0.76) and smoking (p=0.68). VAS leg/back and ODI scores were not significantly different between the drug groups prior to TfESIs: VAS leg (p=0.13); VAS back (p=0.63); ODI (p=0.21) and post-TfESIs VAS leg (p=0.77); VAS back (p=0.96); ODI (p=0.40).More patients in the MPA went on to have a repeat TfESI (p=0.02) and subsequent spinal operation (p=0.21). No significant difference was found between the groups when assessing outcome (p=0.49), satisfaction (p=0.20), and if the injection worked (p=0.66).
Conclusion: We found no significant difference in outcome between MPA and DXM when used in TfESI for radiculopathy due to disc prolapse. However, the DXM group was a smaller cohort with shorter follow-up and we plan to re-evaluate their results in one year to give comparable cohorts.

INTRODUCTION

Radicular pain follows the injury or compression of a dorsal root ganglion, resulting in the sensation of pain that radiates away from the spine into the lower extremities [1,2]. Irritation of a dorsal root ganglion is most commonly caused by a disc herniation[1,3]. Intervertebral (IV) discs are plates of fibrocartilage found between adjacent vertebra in the spinal column that act as shock absorbers and are made of an inner gelatinous substance called the nucleus pulposus, which is surrounded by a fibrous coating called the annulus fibrosus[4,5]. In a disc prolapse/herniation, the nucleus pulposus bulges beyond the limit of the surrounding annulus fibrosus and into the spinal canal, often in a posterolateral direction[6-8]. The protrusion can cause compression of a dorsal root ganglion, leading to radicular pain[7]. Disc prolapses are more commonly seen in the lumbar region at L4/5 and L5/S1[6].

Leg pain is often encompassed within radicular pain due a disc prolapse, and can cause great distress for a patient. There are several management options available to help with leg pain following a disc prolapse, including: physical therapy; pain relief such as NSAIDs; TfESIs and surgery e.g. a discectomy[8,9]. A gold-standard treatment has not yet been identified for the

treatment of radicular pain[8], however many patients have a TfESI before trying surgical intervention, due to smaller complication risks[10]. Steroids are believed to help with radicular pain by decreasing inflammation following a disc prolapse, giving the IV disc time to heal[11].

Over recent years there has been a trend to move away from particulate to non-particulate steroid use as particulate steroids have been linked to "post-procedural paralysis"[12]. In view of the literature, the lead surgeon changes his practice from using MPA 40mg particulate steroid, to DXM 3.3/6.6mg non-particulate steroid (09/12/16).

Aims

To determine if there is any difference in outcome between MPA and DXM when used as a primary TfESI.

METHODOLOGY

Patient Selection

Using Bluespier database, patients that received a TfESI between 11/01/13 – 06/04/18 were identified. Duplicate names i.e. patients that received more than one TfESI within the aforementioned time-frame, were removed from the study. Each patient number was put into IMPAX in order to access the sagittal T2-weighted MRI of the lumbar spine and determine the pathology causing their radicular leg pain. Patients that presented with only a disc prolapse were kept in the study, while patients with other pathologies of the spine were removed.

The remaining patient notes were accessed via Clinical Portal in order to determine any prior spinal treatments. Patients with a previous spinal operation or a TfESI prior to 11/01/13 were removed. Patient notes were used to also find when the spinal surgeon changed from using MPA to DXM.

Outcome Measures

All patients received patient-reported outcome measures (PROMs), which included questionnaires about the patient's health and quality of life both prior to and six weeks following their TfESI[13,14]. The PROMS consisted of a Visual Analog Scale (VAS) for back and leg pain. The results ranged from 0 to 10, with 0 equating to "no pain", and 10 to "worst pain"[15]. This enabled an easy and effective method of comparing the relief provided by the epidural injections.

In addition to VAS, the patients completed the Oswestry Low Back Pain Disability Questionnaire. This consisted of 10 topics followed by six statements, for example:

"Pain intensity:

-I have no pain at the moment

-The pain is very mild at the moment

-The pain is moderate at the moment

-The pain is fairly severe at the moment

-The pain is very severe at the moment

-The pain is the worst imaginable at the moment"

The Oswestry Disability Index (ODI) is the outcome, ranging from 0 (no disability) to 100 (bed-bound)[16].

At their six-week follow-up appointment, patients were asked about their symptoms relief in order to determine if their TfESI had "worked". Patient results were placed into the following categories: worked; worked then pain recurred; didn't work. Patients were asked to complete a questionnaire asking if they were satisfied with their results. From notes written by the spinal surgeon at the follow-up appointment, we could assess Outcome, with a positive outcome being any form of symptom relief.

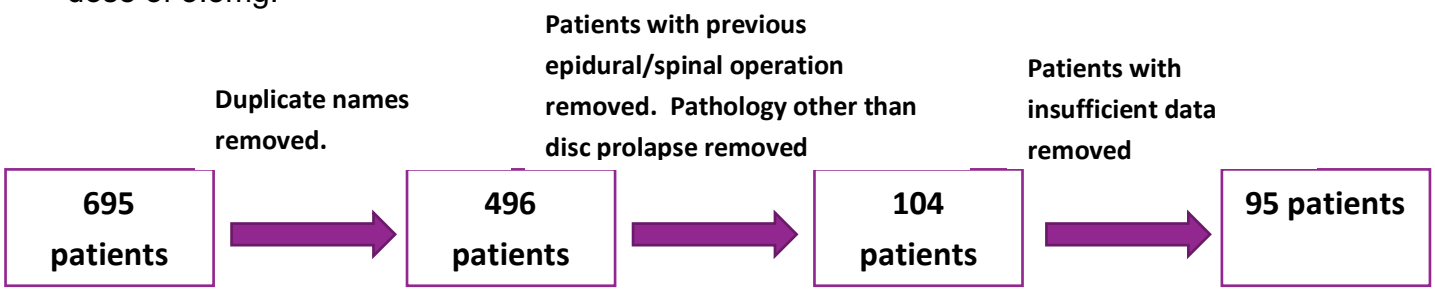
Statistical Analysis

Data collected was inserted into Microsoft Excel and then placed into IBM SPSS Statistics. Changes in VAS back/leg and ODI pre- and post-TfESI were measured and compared. The change in VAS and ODI scores were also compared between the two drug groups. These results were calculated via the Independent Samples T-Test. Chi-Square tests were performed to determine the difference between categorical variables e.g. gender.

A statistical significance of $p<0.05$ was accepted.

RESULTS

Initially, 695 patients were identified on Bluespier (11/01/13-06/04/18). After all the criteria was met, 95 patients remained in which 28.4% (27/95) received MPA and 71.6% (68/95) received DXM. 58.9% (56/95) patients received a TfESI on the left side, while 41.1% (39/95) received a TfESI on the right. Of the 27 patients that received DXM, 7 had a dose of 6.6mg and 20 had a dose of 3.3mg.



Of the patients that received DXM as an ESI, 59.3% (16/27) were male and 40.7% (11/27) female. Of the patients that received a MPA TfESI, 55.9% (38/68) were male and 44.1% (30/68) female. The variation in gender between the two drug groups was not statistically different (p=0.76). Of the DXM group, 50% were smokers at the time of their TfESI and of the MPA group, 44.2% were smokers (p=0.68).

Table 1 Comparing VAS and ODI scores pre- and post-TfESI

Questionnaire Score	Drug	Number of patients	Mean	Std. Deviation	Std. Error Mean	p value
Pre-ESI VAS leg	DXM	12	8.5833	1.44338	.41667	0.13
	MPA	56	7.7143	1.86562	.24930	
Post-ESI VAS leg	DXM	12	5.7500	3.67114	1.05977	0.68
	MPA	56	5.2857	2.49883	.33392	
Pre-ESI VAS back	DXM	12	6.5000	2.90767	.83937	0.63
	MPA	56	6.8929	2.42471	.32402	
Post-ESI VAS back	DXM	12	4.8333	3.53768	1.02124	0.82
	MPA	56	5.0893	2.55326	.34119	
Pre-ESI ODI	DXM	12	55.8333	21.51462	6.21074	0.21
	MPA	56	48.2143	18.10546	2.41944	
Post-ESI ODI	DXM	12	40.3333	33.22467	9.59114	0.82
	MPA	56	42.7143	20.68439	2.76407	

Of the 95 patients collected in the study, 71.6% (68/95) patients fully competed the pain and disability questionnaires (VAS and ODI respectively).

The DXM group post-TfESI showed a mean decrease of 30.0% in VAS leg, 25.6% in VAS back and 27.8% in ODI. The results of the MPA group post-TfESI showed a mean decrease of 31.5% in VAS leg, 26.2% in VAS back and 11.4% in ODI.

Fig.1 Change in VAS leg score (delta leg) pre- and post-TfESI.

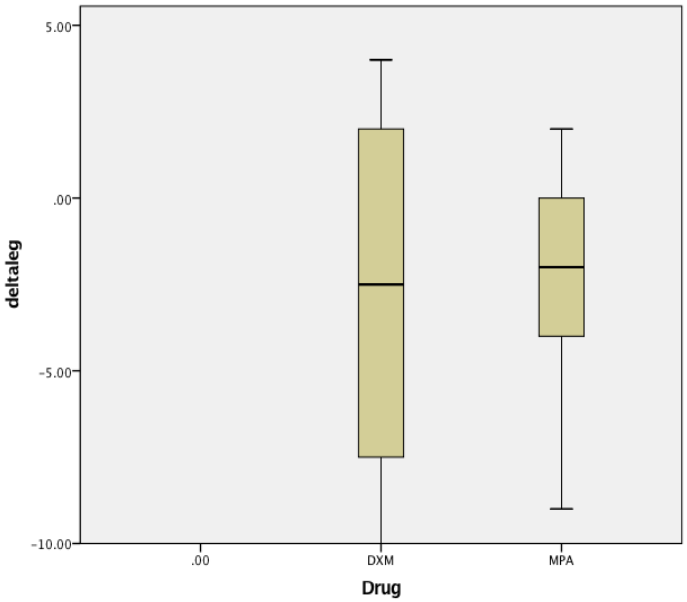


Fig 2. Change in VAS back score (delta back) pre- and post-TfESI.

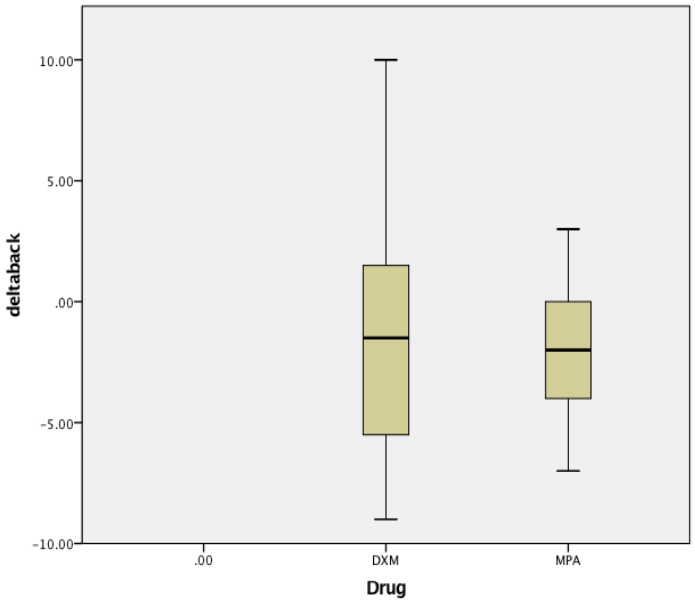
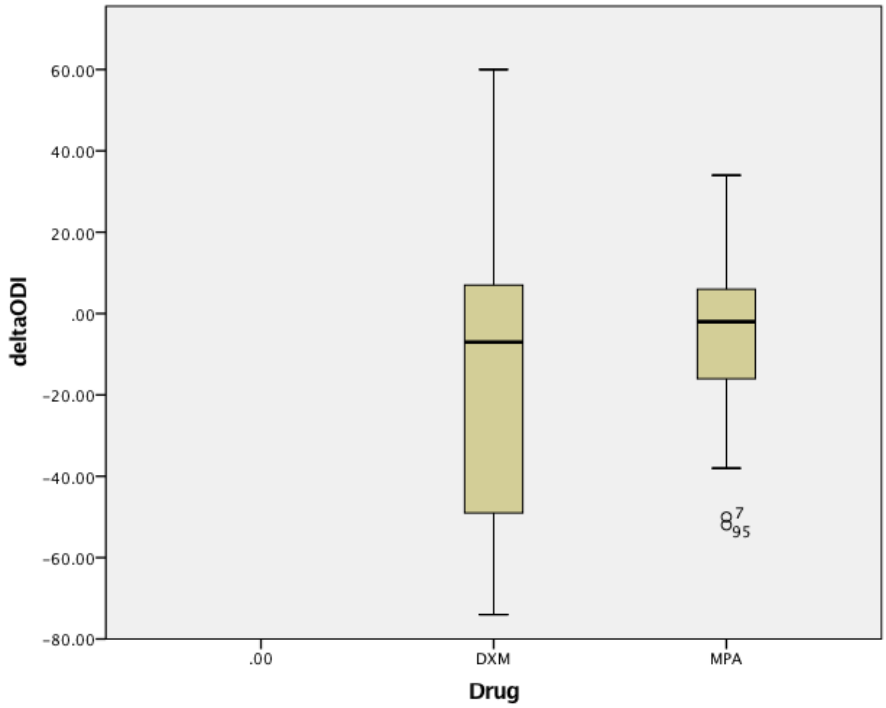


Fig.1 Change in ODI score (delta ODI) pre- and post-TfESI.



We compared the change in VAS leg scores pre- and post-TfESI, and found that the average pain scores decreased by 2.8 for DXM and 2.4 for MPA. (Fig.1). There was no significant difference in change of VAS leg score between the drug groups (p=0.77). The results showed more variability in the DXM patients than MPA patients (std. deviation 5.0 vs 2.6 respectively). The treatment effect was rather small (0.45) and the confident intervals were wide (-3.7 to 2.8).

When comparing back VAS score pre- and post-operation between the two drugs the results showed a decrease in mean score of 1.7 for both drug groups (Fig.2). There was no significant difference between the changes when comparing the drugs (p=0.96). There was more variability in the DXM patients than MPA patients (Std. deviation 5.5 vs 2.4 respectively); although the estimate of treatment effect was small (0.08), the confidence intervals were wide (-3.5 to 3.6).
Comparing changes in ODI pre- and post- TfESI, the results showed that the average scores decreased by 15.5 for DXM patients and 5.2 for MPA patients (Fig.3). There was no significance between the decrease in ODI score between the drug groups (p=0.40). There was much more variability in the DXM patients (Std. deviation of 40.0) compared to MPA patients (Std. deviation of 17.4). The estimate of treatment effect was fairly large (10.31) and the confidence intervals were wide (-36.0 to 15.4). *The two circles and number below the results for MPA in Fig.3 represent anomalous results.*

Table 2. Summary of patients that found their primary TESI to: work, work with pain recurring, or not work at all

		Drug		
		DXM	MPA	Total
Did it work?	didn't work	8	21	29
	worked then pain recurred	5	24	29
	worked	10	21	31
Total		23	66	89

Table 3. Summary of patients that went on to have another TESI

		Drug		
		DEX	MPA	Total
Repeat TESI	no repeat	24	44	68
	repeat	3	24	27
Total		27	68	95

Table 2 gives data for 89 patients (missing data n=5). 25.8% (23/89) received DXM and 74% (66/89) received MPA. Of those that underwent a DXM TfESI: 34.8% had no pain relief; 21.7% said that the ESI worked, but then their pain returned; 43.5% found the TfESI to have worked. Of those that underwent a MPA TfESI: 32.6% had no pain relief; 32.6% found the TfESI to work but then pain recurred; 34.8% found the TfESI to work. A Linear-by-Linear Association Test showed there to be no significant difference in the results between the DXM and MPA patients (p=0.66)

Results of all 95 patients included in the study were included in Table 3. The results showed that of the 27 patients that received DXM, 11.1% of them went on to have a repeat nerve block injection (TfESI). Of the 68 patients that received MPA, 35.3% went on to have a repeat TfESI. The results between the two drug groups are statistically different (p=0.02). 26.0% (7/27) of the 27 DXM patients went on to have a spinal operation after their primary TfESI compared to 39.7% (27/68) of MPA (p=0.21).

We compared the outcome (i.e. “was there any improvement of your symptoms?”), between the drug groups (n=81), which showed that of the 24 patients included that received DXM as their primary TfESI 62.5% found it improved their symptoms. Of the 67 patients included that received MPA, 70.1% noticed an improvement in their symptoms (p=0.49). Patients were also asked to complete a questionnaire to state if they were satisfied with the results of the TfESI. Only 43 patients completed this (missing n= 52). Of the DXM groups 66.7 % (6/9) were satisfied, and of the MPA group 85.3% (29/34) were satisfied (p=0.20)

DISCUSSION

There are many studies that conclude the effectiveness of dexamethasone and methylprednisolone when used as a TfESI for radicular pain (17,18,19,20). The main objective of this study was to determine if there is any statistical significance between MPA and DXM when used as a primary TfESI to treat radicular pain caused by a disc prolapse.

We compared the two patient groups included in the study prior to their TfESIs to look for demographic differences. There was no significant difference in variation of gender and those who smoked between the groups. We also compared the pre-TfESI VAS and ODI scores which showed no significant difference between the drug groups: VAS leg (p=0.134); VAS back (p=0.625); ODI (0.205). The lack of significant difference between the two groups of patients pre-TESI enabled us to be confident that any results post-TfESI with a p value > 0.05 were in fact statistically significant, and not due to variation in the cohorts initially.

Both DXM and MPA caused a mean decrease in scores for VAS leg/back and ODI. Due to the wide confidence intervals seen in Fig. 1, Fig. 2 and Fig.3 for delta leg, back and ODI respectively, one could not rule out a meaningful benefit for either DXM or MPA. For each result, DXM yielded a larger spread or results, this was likely due to the very small sample size[21] (n=12) included. With a small sample size, an anomaly has a large impact on the distribution. However, it should be recognized that ≥1 patient had an increase in back pain by 100% (10/10), and ≥1 patient had a 60% (6/10) increase in ODI. These results could show an adverse effect of DXM on certain patients, or be anomalies.

When looking at the number of patients that went on to have a repeat TfESI due their primary injection not being sufficient, there was a statistical difference between the drug groups (p=0.02), with a much higher percentages of the MPA group going on to having another injection suggesting that MPA is less effective than DXM. However, it is important to note that

the patients in this study that received DXM as the steroid in their TfESI have had a much shorter follow-up time compared to those that received MPA, as the change in drug only occurred 16 months prior to this study. Of the 27 patients that went on to have a repeat ESI in the MPA group, 12 of these were after a year – most patients in the DXM group do not yet have a year's follow-up. We therefore cannot conclude which drug results in more patients going on to have a repeat injection.

Although no significant difference was seen between the drug groups for the number of patients that went on to have spinal operation, again it is worth mentioning the lack of follow-up time for DXM which had a large impact on these results.

No statistical difference was found between the drug groups for patient outcomes, patient satisfaction and as to whether the patients found their TfESI to work

CONCLUSION

The results do not show any conclusive evidence of one drug being superior to the other in the treatment of radicular leg pain due to disc prolapse when comparing dexamethasone (a non-particulate steroid) to methylprednisolone acetate (a particulate steroid). However, due to the discrepancy in cohort sizes, we plan to reevaluate the results in one year in order to give comparable cohorts and aid in ascertaining the most appropriate treatment for clinical practice going into the future.

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