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Ultrasound-guided intra-sacroiliac joint injection — methylprednisolone versus triamcinolone: a randomized comparative study

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Abstract

Background The sacroiliac joint (SIJ) has been considered as a pain generator in about 10% to 25% of patients with leg or low back pain. The current study was conducted to compare the effectiveness of ultrasound-guided intra-articular SIJ injection of methylprednisolone versus triamcinolone acetonide according to postinjection pain relief, the random blood glucose (RBG) level in diabetic patients, quality of life (QoL), patient's satisfaction, and the analgesic requirement.

Results NRS was better at rest and at motion in MTP groups 3 (2–3) and 4 (3–5) compared to TMC groups 4 (3–5) and 5 (3–6) at 2 weeks after injection with statistically significant difference *P* equal 0.025 and 0.036, respectively, while there was no statistically significant difference between the studied groups at 1, 2, and 3 months after injection. The RBG level was higher in the MTP group in the 1st, 2nd, and 3rd days after injection 206 (168–308), 245 (200–385), and 215 (179–343) compared to the TMC group 170 (136–271), 168 (119–233), and 166 (110–253) with statistically significant difference *P* equal 0.066, 0.045, and 0.049, respectively. However, there was no statistically significant difference in the RBG level at baseline, 4th, 5th, 6th, and 7th days after injection between the two studied groups. Moreover, there was a statistically significant elevation in the RBG level within the MTP group in the first 3 days compared to the baseline ($P < 0.001$). There was no statistically significant difference according to QoL, patient's satisfaction, and the analgesic requirement between both groups.

Conclusions SIJ injection with methylprednisolone or triamcinolone acetonide showed an improvement in pain score, while the MTP group was better in NRS at 2 weeks. Also, the RBG level in diabetic patients was higher in the MTP group in the 1st, 2nd, and 3rd days after injection. There was upgrading in QoL, similarity in patient's satisfaction, and reducing the use of analgesia with no statistically significant difference between the studied groups.

Keywords Sacroiliac joint, Methylprednisolone, Triamcinolone

Background

The sacroiliac joint (SIJ) has been considered as a pain generator in about 10% to 25% of patients with leg or low back pain (Thawrani et al. 2019). Inflammatory arthritis, patients with leg length discrepancy, pregnancy, advanced age, trauma, and previous spine surgeries increase the risk of SIJ pain (Huynh and Hsu 2019).

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The anatomical structure and inter-individual variations in SIJ render its injections challenging to do without any guidance (fluoroscopy, ultrasound, or computerized tomography) (Wu et al. 2021). When ultrasound-guided injection compares to other guidance, it provides accurate, safe, inexpensive imaging, easy, non-invasive, and lacking exposure to radiation (Rosenberg et al. 2000).

Intra-articular steroids injection is a good alternative for the patients with SIJ osteoarthritis as it delays any surgical intervention with better pain relief and thereby the patient's quality of life (QoL) will improve (Najm et al. 2021).

Among the common steroid preparations available, methylprednisolone (MTP) and triamcinolone acetonide (TMC) are the two most common particulate steroids used in clinical practice. However, there are lack of studies comparing the two steroids in SIJ injections.

The current study was conducted to compare the effectiveness of ultrasound-guided intra-articular SIJ injection of MTP versus TMC according to postinjection pain relief, the RBG level in diabetic patients, quality of life (QoL), patient's satisfaction, and the analgesic requirement.

Methods

This prospective randomized double-blinded comparative study was conducted in pain clinic, Mansoura university hospital, Egypt. The study was accepted by the Institutional Research Board, Faculty of Medicine, (MS 20.07.1195), and the ClinicalTrials.gov registration (NCT05134181) and was carried out in compliance with the Helsinki Declaration. All participants signed an informed consent after explanation of all details about the study.

Age between 50 and 70 years of both sexes; sacroiliac pain with at least 3 positive tests of the 5 provocative tests (Gaenslen test, FABER/Patrick's test, thigh thrust, anterior superior iliac spinous distraction, and iliac compression); pain was not alleviated by the conservative therapy (rest, topical menthol, ice/heat, lidocaine patch, NSAIDs, pelvic belt, and physical therapy) for 4 weeks; and positive diagnostic test (intra-articular SIJ injection with 2-ml lidocaine 2% 1 day before the procedure) were included in this study.

The exclusion criteria were patient's refusal to participate in the study, history of immunosuppression diseases, bleeding disorders, septic joint, local skin infection, renal patients (serum creatinine > 1.8 mg/dl), osteomyelitis, local malignancy, decompensated liver diseases, previous history of chronic opioid use, psychiatric disorders affecting cooperation, intra-articular sacroiliac injection within previous 3 months, hypersensitivity or allergy to any of the study medications, negative diagnostic test, morbid obesity (BMI > 40 kg/m^2), and diabetes mellitus (type 2 with history of poor glycemic control).

CT was performed to all included patients to confirm diagnosis of SIJ dysfunction and excluded other sources of low back pain. All the patients were informed about numerical rating scale (NRS) for pain from zero to 10 to describe their pain (0 = no pain, while 10 = worst pain). The resident in the pain clinic asked the patients about their QoL by using EQ-5D-5L questionnaire which contains five items: mobility, self-care, usual activities (e.g., work, study, housework, or family activities), pain or discomfort, and anxiety or depression, and each item ranges from no, slight, moderate, severe, or unable (Devlin et al. 2018). Also, the RBG level in diabetic patients was measured, and the analgesic requirement was recorded.

Sample size calculation

Sample size was calculated according to the mean NRS score after 20-min walk between the studied groups (methylprednisolone and triamcinolone acetonide) recorded at 8 weeks after injection (5.61 & 6.30), respectively (Jain and Jain 2015), using G*Power version 3.0.10 to calculate SD difference of (0.09) with effect size = 0.64, α error = 0.05, and power = 80.0%. The calculated sample size was 40 patients in each group and with adding 10% to compensate for drop out, and then, the total sample size was 45 patients at least in each group

Randomization

The randomization was performed using sealed envelopes indicating the group of the assignment at the time of the first visit to the pain clinic by a chief nurse, who read the number inside the envelope and determined group assignments, but did not join in patients' follow-up.

Patients were randomly allocated into 2 equal groups (Fig. 1):

- Group MTP: (n = 45) received ultrasound-guided intra-articular sacroiliac injection with 2 mL of 2% lidocaine hydrochloride and 40 mg of methylprednisolone.
- Group TMC: (n = 45) received ultrasound-guided intra-articular sacroiliac injection with 2 mL of 2% lidocaine hydrochloride and 40 mg of triamcinolone acetonide.

Technique of ultrasound-guided intra-articular SIJ injection (Harmon and Michael 2008)

At patient arrival to recovery room, an IV line was secured, normal saline 0.9% solution was infused, and

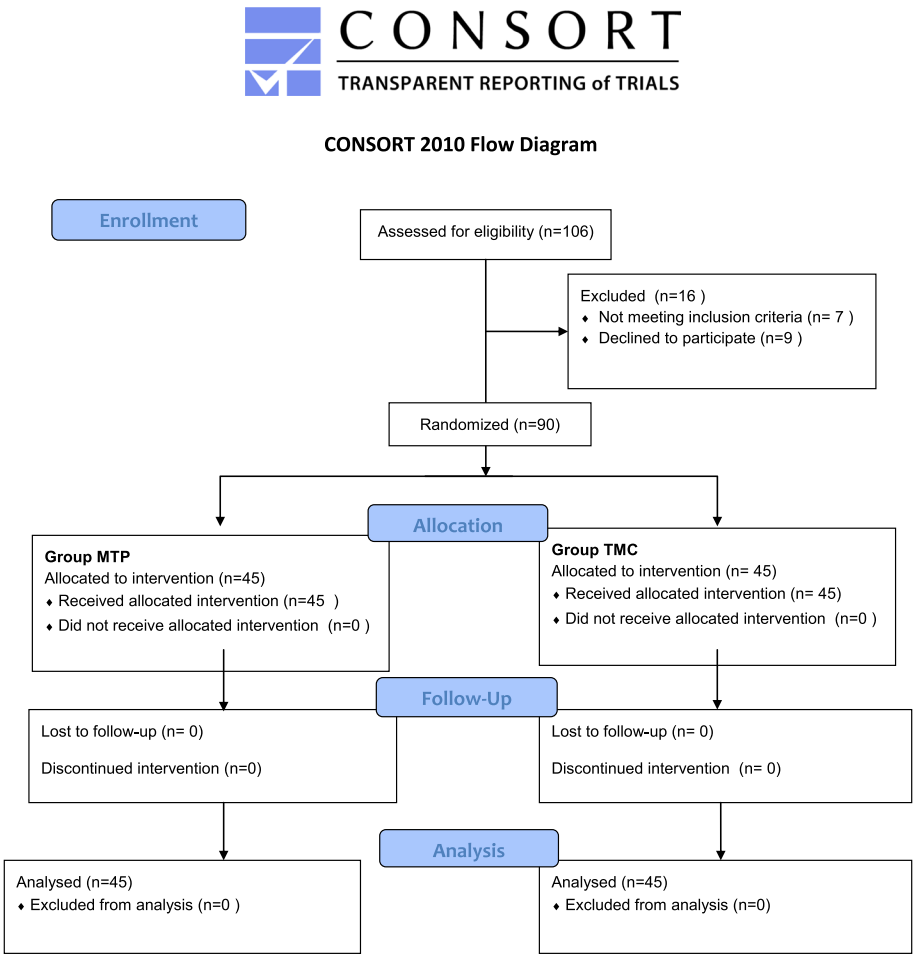

Fig. 1 Consort flow chart

oxygen mask (3 l/min) was supplemented. Heart rate, blood pressure, and saturation were monitored. At complete aseptic conditions, ultrasound at frequency of 4–5 MHz was used. Patient was in prone position. The ultrasound probe was oriented at the level of the sacral hiatus in a transverse orientation; the sacral cornua were recognized. The probe was moved laterally until identify the lateral edge of the sacrum. In a transverse orientation, the bony edge of the sacrum is followed in a cephalad direction. The second bony contour was the ileum. The cleft between the two bony contours was the SIJ. The depth was at about 4.5 cm. A 22-G spinal needle was directed into the SIJ under real-time imaging. Also, under direct vision, 2 mL of 2% lidocaine and 40-mg methylprednisolone or 40-mg triamcinolone acetonide was injected (Fig. 2). The needle was withdrawn, and a sterile dressing was applied. Then, the patient laid down in supine position. The blood pressure, O2 saturation, heart rate, and any adverse effect was monitored for at least 30 min.

If the NRS was ≥ 4, NSAID in the form of 20-mg piroxicam was given once daily after meal to control the pain.

Evaluation

Primary outcome

NRS at rest and during motion (during stair climbing or standing up from a seated position or walking) before injection and at an interval of 2 weeks and 1, 2, and 3 months after injection was assessed.

Secondary outcomes

The RBG level in diabetic patients before and on the first 7 days after injection; QoL by using EQ-5D-5L before injection and after 1 month of injection including mobility, self-care, usual activity, pain/discomfort, and anxiety/depression; the patient's satisfaction (not satisfied, satisfied, and highly satisfied), and the analgesic requirement (20-mg piroxicam) were evaluated.

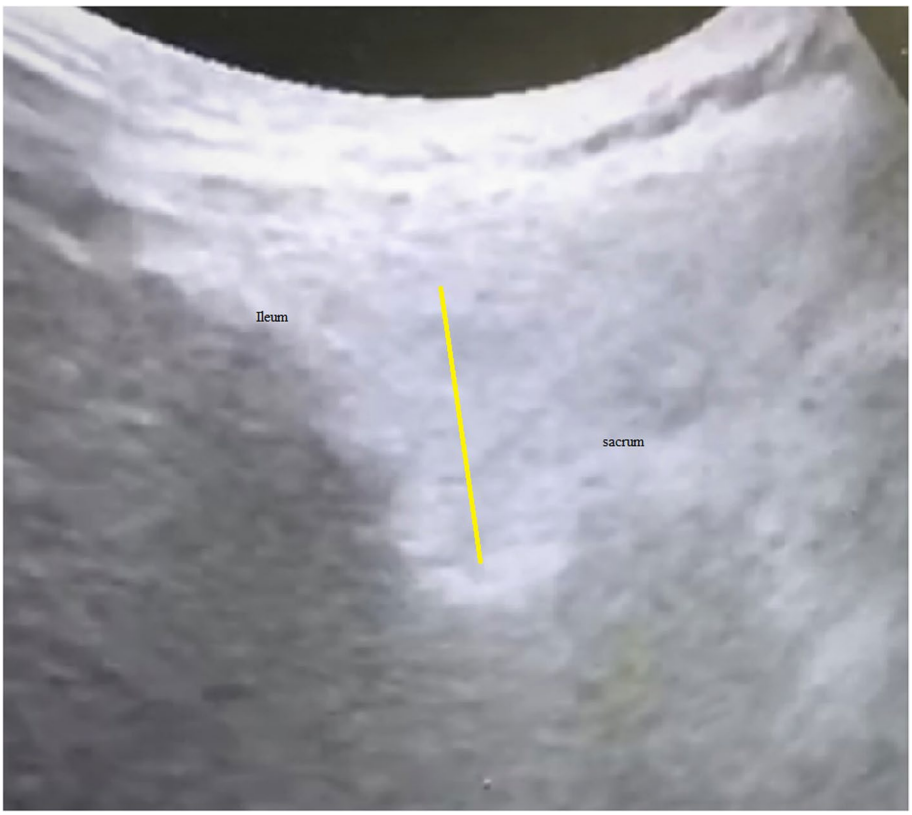

Fig. 2 Ultrasound view of the SIJ shows the ileum and the sacrum. The yellow line is the track of the needle entrance

Statistical analysis

Data were analyzed using version 22 SPSS (Statistical Package for the Social Sciences). Qualitative data was presented as number and percent. Kolmogorov-Smirnov test was used for normality of quantitative data where the normal distributed data described as mean and standard deviation while the non-normally distributed data described as median and range. The appropriate statistical test was applied according to data type; categorical variable and chi-square were used. Continuous variables, Mann-Whitney *U*-test, and Student's *t*-test were used. The probability (P) was considered statistically significant if it was less than 0.05.

Results

According to the mean age of patients, in the MTP group was 59.11 ± 7.33 and in the TMC group was 61.47 ± 6.91 years with no statistically significant difference between the two groups. The females represented the highest percentage of the cases (71.1% and 73.3%), while males represented 28.9% and 26.7% in the MTP and TMC groups respectively with no statistically significant difference between the two groups. The mean BMI in the MTP group was 31.59 ± 4.20 kg/m^2 and in the TMC group was 32.08 ± 3.63 with no statistically significant difference between the two groups. There was no statistically significant difference between the duration of the disease, ASA score, and number of diabetic patients between the two groups. The left side was affected in 68.9 and 62.2%, and the right side was affected in 31.1% and 37.8% in the MTP and TMC groups respectively with no statistically significant difference between the two groups (Table 1).

Table 2 shows that NRS was better at rest and at motion after injection in MTP group at 2 weeks than TMC group with statistically significance *P*-values 0.025 and 0.036, respectively, while there was no statistically significant difference in the NRS at rest and at motion between the two groups at the baseline and in 1, 2, and 3 months after injection. Within groups, there was a statistically significant decrease in the NRS at rest and at motion in 2 weeks and 1, 2, and 3 months after injection compared to the baseline.

Table 3 shows increase in the RBG level in MTP group in the 1st, 2nd, and 3rd days after injection 206 (168-308), 245 (200–385), and 215 (179–343) compared to TMC group 170 (136–271), 168 (119–233), and 166 (110–253) with statistically significant difference *P* equal 0.066, 0.045, and 0.049, respectively. However, there was no statistically significant difference in the

Table 1 Demographic data, duration of the disease, number of diabetic patients, and the affected side of SIJ in the two studied groups

	MTP group ($N = 45$)		TMC group ($N = 45$)		Test of significance	*p*-value
Age (years)	59.11 ± 7.33		61.47 ± 6.91		$t = 0.638$	0.525
Sex						
Male	13	28.9%	12	26.7%	$X^2 = 0.055$	0.814
Female	32	71.1%	33	73.3%		
BMI (kg/m^2)	31.59 ± 4.20		32.08 ± 3.63		$t = -0.588$	0.558
Disease duration (months)	19.11 ± 12.33		17.47 ± 12.12		$t = 0.638$	0.525
Number of diabetic patients	23(51.1%)		19 (42.2%)		$X^2 = 0.323$	0.5699
Side						
Right	14	31.1%	17	37.8%	$X^2 = 0.443$	0.506
Left	31	68.9%	28	62.2%		

P probability. Continuous data are expressed as (mean ± SD). Categorical data expressed as number (%). χ^2 chi-square test. *t* independent samples *t*-test. *FET* Fisher's exact test

Table 2 Numerical rating score at rest and at motion in the two studied groups along the study period

	MTP group ($N = 45$) At rest	TMC group ($N = 45$) At rest	Test of significance	*p*-value	MTP group ($N = 45$) At motion	TMC group ($N = 45$) At motion	Test of significance	*p*-value
Before injection	5 (5–7)	6 (5–7)	$z = -0.445$	0.656	6 (5–8)	7 (5–8)	$z = 0.949$	0.343
At 2 weeks after injection	3 (2–3)	4 (3–5)	$z = -2.648$	0.025*	4 (3–5)	5 (3–6)	$z = 2.481$	0.036*
P1	**< 0.001***	**< 0.001***			**< 0.001***	**< 0.001***		
At 1 month after injection	2 (1–3)	2 (1–3)	$z = -0.704$	0.482	3 (2–4)	3 (2–4)	$z = 0.863$	0.388
P1	**< 0.001***	**< 0.001***			**< 0.001***	**< 0.001***		
At 2 months after injection	3 (2–4)	3 (2–4)	$z = -0.354$	0.723	4 (2–5)	3 (2–5)	$z = 0.127$	0.899
P1	**< 0.001***	**< 0.001***			**< 0.001***	**< 0.001***		
At 3 months after injection	4 (3–5)	4 (3–5)	$z = -0.943$	0.345	5 (4–6)	5 (4–7)	$z = 0.813$	0.416
P1	**0.022***	**0.025***			**0.029***	**0.035***		

P probability. Continuous data are expressed as median (range). *z* Mann-Whitney *u*-test. *P1* significance in relation to initial (basal value). *Statistically significant ($P < 0.05$)

RBG level at baseline, 4th, 5th, 6th, and 7th days after injection between the two studied groups. Moreover, there was statistically significant elevation in the RBG level within MTP group in the first 3 days compared to the baseline ($P < 0.001$), and there was no statistically significant difference at the rest of the week. Also, there was no statistically significant difference in TMC group in all days of the week compared to before injection.

Table 4 shows that there was no statistically significant difference in the QoL in all domains of EQ-5D-5L questionnaire between the two groups before injection.

Table 5 shows that there was no statistically significant difference in the QoL in all domains of EQ-5D-5L questionnaire between the two groups after injection. However, there was a statistically significant improvement in all domains of the QoL according to before and after injection in both groups with $P < 0.001$.

Table 6 shows that there was no statistically significant difference in the patient satisfaction between the two groups. Four patients in MTP group and five patients in TMC group were not satisfied. A total of 77.8% in MTP group and 75.6% in TMC group were satisfied, while 6 patients in each group were highly satisfied. There was no statistically significant difference in the analgesic requirement (20-mg piroxicam) between the two groups (24.4% in MTP group and

Table 3 The random blood glucose of the diabetic patients in the two studied groups before and after 1 week from injection

	MTP group ($N = 23$)	TMC group ($N = 19$)	Test of significance	*p*-value
Before injection	165 (114–246)	156 (122–250)	$z = -0.723$	0.248
1 day after injection	206 (168–308)	170 (136–271)	$z = -2.752$	**0.066***
P1	**< 0.001***	**0.678**		
2 days after injection	245 (200–385)	168 (119–233)	$z = -2.856$	**0.045***
P1	**< 0.001***	**0.140**		
3 days after injection	215 (179–343)	166 (110–253)	$z = -2.426$	**0.049***
P1	**< 0.001***	**0.503**		
4 days after injection	170 (121–251)	164 (112–240)	$z = -0.652$	0.305
P1	**0.309**	**0.693**		
5 days after injection	164 (112–246)	165 (119–236)	$z = -0.569$	0.456
P1	**0.507**	**0.433**		
6 days after injection	166 (110–257)	164 (123–237)	$z = -0.625$	0.260
P1	**0.495**	**0.547**		
7 days after injection	160 (119–230)	169 (125–239)	$z = -0.589$	0.326
P1	**0.810**	**0.232**		

P probability. Continuous data are expressed as median (range). *z* Mann-Whitney *u*-test. *P1* significance in relation to initial (before injection value). *Statistically significant ($P < 0.05$)

20% in TMC group), while in each group the analgesic requirement was decreased with statistically significant difference P1 equal 0.0254 in MTP group and 0.0098 in TMC group.

Discussion

Several studies showed good efficacy and safety of steroids intra-articular injections to treat osteoarthritis. But still the type of steroids is up to doctor's expertise (Bellamy et al. 2006; Gaujoux-Viala et al. 2009).

The current study was conducted to compare the effectiveness of ultrasound-guided intra-articular SIJ injection of MTP versus TMC according to NRS, the random blood glucose in diabetic patients, QoL, patient's satisfaction, and the analgesic requirement.

In this trial, the intra-articular SIJ injection was performed with ultrasonic guidance because blind technique has high failure rate. Also, there were various advantages of ultrasound over other guidance that it is easily available imaging method with less radiation, economical, real time, and reproducible (Pekkafalı et al. 2003; Singla et al. 2017).

Kumar et al. studied the efficacy of triamcinolone acetonide versus methylprednisolone intra-articular knee injection and found that there was a significant drop in pain and swelling scores during the follow-up periods ($P < 0.001$) in both groups. However, within groups, there were no significant differences up to 6 months. This is consistent with our results as there was a decline in NRS in each group during the follow-up periods compared to the baseline, and there was no significant difference between the studied groups at 1, 2, and 3 months after injection (Kumar et al. 2017).

Another trial randomized 120 patients with knee pain which compared three types of steroids: triamcinolone acetonide, methylprednisolone, and betamethasone disodium phosphate intra-articular injection. The three steroids promoted functional and symptomatic improvement for up to 3 months. However, methylprednisolone was more effective in relieving pain compared with the others until week 6 ($P < 0.05$). In our study, MTP group showed significant improvement difference at 2 weeks compared with TMC group at rest $P = 0.025$ and at motion $P = 0.036$ (Yavuz et al. 2012).

This can be explained by the fact that particulate steroids, such as methylprednisolone acetate and triamcinolone acetonide, are composed of microcrystals ranging from 3 to 15 times the size of erythrocytes. Triamcinolone acetonide, being the least soluble steroid agent with the greatest potency, has densely packed particles that differ in size ranging from 15 to 60 μm. In comparison, methylprednisolone acetate has uniformly sized, densely packed particles ranging from 0.5 to 26 μm in size, with < 5% of particles > 50 μm in diameter that do not form many aggregations, and this makes it more soluble (Shah et al. 2019).

The findings in the current study are in contrast to Pyne et al. who reported that triamcinolone was statistically more efficient in pain relief 3 weeks after intra-articular knee injection than methylprednisolone (Pyne et al. 2004).

Table 4 QoL in the two studied groups before injection

	MTP group ($N = 45$)		TMC group ($N = 45$)		Test of significance	*p*-value
Mobility						
No problems	5	11.1%	5	11.1%	$X^2 = 0.296$	0.990
Slight problems	9	20%	9	20%		
Moderate problems	9	20%	10	22.2%		
Severe problems	11	24.4%	9	20%		
Extreme problems	11	24.4%	12	26.7%		
Self-care						
No problems	10	22.2%	11	24.4%	$MC = 1.377$	0.848
Slight problems	7	15.6%	10	22.2%		
Moderate problems	15	33.3%	12	26.7%		
Severe problems	7	15.6%	8	17.8%		
Extreme problems	6	13.3%	4	8.9%		
Usual activities						
No problems	6	13.3%	7	15.5%	$X^2 = 0.457$	0.978
Slight problems	10	22.2%	8	17.8%		
Moderate problems	11	24.4%	10	22.2%		
Severe problems	11	24.4%	12	26.7%		
Extreme problems	7	15.5%	8	17.8%		
Pain/discomfort						
No problems	3	6.7%	3	6.7%	$MC = 0.820$	0.963
Slight problems	6	13.3%	5	11.1%		
Moderate problems	7	15.6%	10	22.2%		
Severe problems	18	40%	18	40%		
Extreme problems	11	24.4%	9	20%		
Anxiety depression						
No problems	4	8.9%	1	2.2%	$MC = 2.528$	0.640
Slight problems	8	17.8%	6	13.3%		
Moderate problems	15	33.3%	16	35.6%		
Severe problems	12	26.7%	15	33.3%		
Extreme problems	6	13.3%	7	15.6%		

P probability. Categorical data expressed as number (%). X^2 chi-square test. *MC* Monte-Carlo test. *Statistically significant ($P < 0.05$)

Choudhry et al. performed a systematic review of studies observing the outcome of intra-articular steroid injections on blood glucose levels in patients with diabetes mellitus, and they stated that intra-articular steroid injections elevate blood glucose level in patients with diabetes mellitus, and it should be regularly monitored for up to a week after injection, while postinjection hyperglycemia happened within 24 to 72 h (Choudhry et al. 2016).

Furthermore, Safran et al. studied the effect of MTP intra-articular shoulder injection on blood glucose level in patients with type 2 diabetes and found that hyperglycemic changes are short lived and are limited up to 2–3 days after injection. This is in agreement with MTP group in our study that showed an elevation in the RBG level at the 1st, 2nd, and 3rd days after SIJ injection with statistically significant difference with TMC group ($P < 0.05$) (Safran et al. 2022).

Feldman et al. evaluated the blood glucose level after intravitreal TMC injection in diabetic patients and concluded that there was no differential effect on blood glucose observed after an intravitreal TMC injection compared with vitrectomy alone (Feldman-Billard et al. 2008).

Transient and limited increase in blood glucose has been reported in nondiabetic patients after intra-articular injections, and its baseline level returned by 24 h (Uboldi et al. 2009; Moon et al. 2014).

Bisicchia et al. measured QoL using the 36-Item Short-Form Survey (SF-36) score after intra-articular knee injection, and they noted improvements in QoL in MTP group extended up to 12 months (Bisicchia et al. 2016). Also Nabi et al. compared the effectiveness of intra-articular platelet-rich plasma (PRP) and TMC injection under ultrasound guidance on knee osteoarthritis and assessed

Table 5 QoL in the two studied groups after injection and comparison between before (Table 4) and after injection

	Group 1 (MTP group) (*N* = 45)		Group 2 (TMC group) (*N* = 45)		Test of significance	*p*-value
Mobility						
No problems	15	33.3%	13	28.9%	*MC* = 0.572	0.966
Slight problems	15	33.3%	16	35.6%		
Moderate problems	6	13.3%	8	17.8%		
Severe problems	5	11.1%	4	8.9%		
Extreme problems	4	8.9%	4	8.9%		
P1	**< 0.001***		**< 0.001***			
Self-care						
No problems	19	42.2%	20	44.4%	*MC* = 1.453	0.835
Slight problems	14	31.1%	16	35.6%		
Moderate problems	7	15.6%	4	8.9%		
Severe problems	3	6.7%	4	8.9%		
Extreme problems	2	4.4%	1	2.2%		
P1	**< 0.001***		**< 0.001***			
Usual activities						
No problems	18	40%	18	40%	*MC* = 2.094	0.719
Slight problems	18	40%	19	42.2%		
Moderate problems	4	8.9%	6	13.3%		
Severe problems	4	8.9%	2	4.4%		
Extreme problems	1	2.2%	0	0%		
P1	**< 0.001***		**< 0.001***			
Pain/discomfort						
No problems	19	42.2%	20	44.4%	*MC* = 0.908	0.923
Slight problems	15	33.3%	17	37.8%		
Moderate problems	6	13.3%	5	11.1%		
Severe problems	4	8.9%	2	4.4%		
Extreme problems	1	2.2%	1	2.2%		
P1	**< 0.001***		**< 0.001***			
Anxiety depression						
No problems	18	40%	17	37.8%	*MC* = 1.204	0.877
Slight problem	15	33.3%	16	35.6%		
Moderate problems	8	17.8%	8	17.8%		
Severe problems	3	6.7%	4	8.9%		
Extreme problems	1	2.2%	0	0%		
P1	**< 0.001***		**< 0.001***			

P probability. *P1* significance in relation to initial (before injection value). Categorical data expressed as number (%). X^2 chi-square test. *MC* Monte-Carlo test.
*Statistically significant ($P < 0.05$)

QoL using the KOOS QoL scale. They found improvements in QoL in both groups, but greater improvements in QoL were seen in PRP group at 3 months ($P = 0.02$) and 6 months ($P < 0.0001$). In the current study, there was no statistically significant difference in QoL between MTP and TMC groups, but there was a statistically significant difference in each group compared to the baseline ($P < 0.001$) (Nabi et al. 2018).

The analgesic requirement was significantly reduced after injection in both groups in our study, and this was in accordance with Jagdish et al., who concluded that the combination injection of intra-articular local anesthetic and corticosteroid is effective and safe, achieves immediate pain relief up to 6 months, and decreases the usage of NSAID (Jagdish et al. 2018).

Fouad et al. reported that 91.2% of patients were satisfied or mostly satisfied after SIJ injection with MTP, and this is within the same line with our result as 77.8% of patients were satisfied and 13.3% were highly satisfied in MTP group which showed no statistically significant difference with TMC group, where 75.6% of

Table 6 Patient satisfaction and the analgesic requirement in the two studied groups

	Groups				Test of significance	*p*-value
	Group 1 (MTP group) (*N* = 45)		Group 2 (TMC group) (*N* = 45)			
The degree of satisfaction						
Not satisfied	4	8.9%	5	11.1%	*MC* = 0.126	0.939
Satisfied	35	77.8%	34	75.6%		0.961
Highly satisfied	6	13.3%	6	13.3%		0.936
The analgesic requirement (20-mg piroxicam)						
Before injection	29	64.4%	31	68.9%	$X^2 = 0.164$	0.6855
After injection	11	24.4%	9	20%	$X^2 = 0.249$	0.617
P1	0.0254		0.0098			

P probability. *P1* significance in relation to initial (before injection value) according to the analgesic requirement. Categorical data expressed as number (%). *MC* Monte-Carlo test. X^2 chi-square test

patients were satisfied and 13.3% were highly satisfied (Fouad et al. 2021).

Conclusions

SIJ injection with methylprednisolone or triamcinolone acetonide showed an improvement in pain score, while MTP group was better in NRS at 2 weeks. Also, RBG level in diabetic patients was higher in MTP group in the 1st, 2nd, and 3rd days after injection. There was an upgrading in QoL, similarity in patient's satisfaction, and a reduction in the use of analgesia with no statistically significant difference between the studied groups.

Abbreviations

SIJ	Sacroiliac joint
MTP	Methylprednisolone
TMC	Triamcinolone acetonide
QoL	Quality of life
NRS	Numerical rating scale
RBG	Random blood glucose

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Authors' contributions

AA and NA conceived of the presented idea. AAZ verified the analytical methods. EK collected the cases. NA and EK did the clinical part in the research. All authors have read and approved the manuscript.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article; we sent in the supplementary information files.

Declarations

Ethics approval and consent to participate

Our study was accepted by the Institutional research board, of Faculty of Medicine, Mansoura University, Egypt (MS 20.07.1195), registered in the ClinicalTrials.gov (NCT05134181) and carried out in compliance with the Helsinki Declaration. All participants signed an informed consent after explanation of all details about the study.

Consent for publication

Every patient participating in this study signed an informed consent after full explanation of all details in this study.

Competing interests

The authors declare that they have no competing interests.

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