Brief Communication

Real-world Outcomes of Ultrasonography-guided Interventions in a Tertiary Hospital

CME Credits

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Abstract

Background: Intervention under ultrasonography (US) guidance has become increasingly prevalent in recent years. This study aimed to assess the treatment response to US-guided musculoskeletal interventions in daily practice. **Methods:** This retrospective study sought to identify the treatment response to US-guided interventions in different tissues conducted between January 2017 and December 2018. The treatment response to various US-guided interventions in different tissues was recorded. The response was further classified into positive response and negative response according to the improvement of symptoms or satisfaction of the treatment. **Results:** Among the 605 interventions included for data analysis, a positive response rate of 81% was observed in this study for all US-guided interventions, ranging from 70% to 88% in different categories. **Conclusion:** This real-world analysis demonstrated the effectiveness of various US-guided interventions without serious complications. We recommend US as a useful guidance for a variety of injections.

Keywords: Injections, retrospective studies, ultrasonography

Introduction

Injection of medications in proximity to nerves, muscles, and skeletal structures is an important intervention in the management of pain and dysfunction.[1] Intervention under ultrasonography (US) guidance has become increasingly prevalent in recent years due to its accuracy, convenience, and real-time imaging, which may result in better clinical responses and less adverse events.[2-4] For instance, US can provide real-time imaging in a convenient and inexpensive manner, targeting multiple lesions without causing unintended injury to neurovascular structures.[5,6]

Moreover, US guidance not only increases accuracy during the procedure but also allows the application of novel procedures, such as hydrodissection in the treatment of peripheral nerve entrapment. This technique may reduce adhesion between the target structure and the surrounding tissue, thereby resolving the entrapment.[7]

Although several meta-analyses have confirmed the efficacy of US-guided interventions in different anatomical locations, there are limited real-world data reporting the treatment responses of the patients in daily clinical practice.[8,9] Therefore, we analyzed the effectiveness of various US-guided interventions with different procedures and anatomical locations which were performed in a tertiary hospital for demonstrating the treatment responses to US-guided interventions in daily practice.

Methods

The protocol of this retrospective cohort study and the request for the waiver of informed consent have been approved by the institutional review board in our hospital (NTUH-REC No.: 201910110RIND).

Patients

The study sample included all patients who had undergone US-guided intervention between January 2017 and December

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2018 in the outpatient clinic of a physiatrist who had 10 years of experience and had performed US-guided intervention for more than 8000 cases. A retrospective review of the electronic clinical records was conducted to collect details regarding the gender, age, primary complaint, diagnosis, intervention date, intervention site, type of procedure, injection medication, and the response of the patient. Exclusion criteria were data without patient response and patients who had received Botox injection for spasticity.

Data categorization

The response of each patient to the US-guided intervention was recorded during the follow-up visit. The response was divided into two groups (positive and negative) for statistical analysis. A positive response was defined as a "yes" to any of the following three aspects:[1] binary response of patients' satisfaction in symptom relief (yes or no),[2] binary response of patients' satisfaction in functional improvement (yes or no), and[3] a decrease of ≥50% of pain in the visual analogue scale after treatment.

After data collection, a descriptive statistical analysis was conducted under the following two types of categories to evaluate the effectiveness: the histological type of the tissue injected and the type of the procedure. The histological type of the tissue was divided into the joint, the tendon and the ligament, the muscle and the fascia, and the bursa. Furthermore, different sites in one histological type were analyzed separately when the response rates were different.

The types of procedure included trigger point injection, hypertonic dextrose injection, intra-articular injection, nerve hydrodissection, and subacromial–subdeltoid (SASD) bursa injection. For trigger point injection, the trigger point was localized by deep palpation. After aseptic skin preparation, a 1½–2" (4–5-cm), 22–25G needle was advanced into the muscle, and the medication was injected in a counterclockwise manner. Local twitch responses were confirmed under US guidance. Commonly used regimens include 10–40 mg triamcinolone and 5 mL of 1% lidocaine.[1,10] For hypertonic dextrose injection, the following two concentrations are commonly used: 15% dextrose for periarticular injections of tendon and ligament attachments and 25% dextrose for intra-articular injections. Furthermore, 20% dextrose is used for injection to both intra-articular and periarticular tissues at the same time; 1% lidocaine without epinephrine and 0.9% saline are typical diluents. For intra-articular injection, the needle is inserted into the skin, the joint capsule, and the synovial lining, sliding into the joint cavity under US guidance. Medications such as triamcinolone, lidocaine, and hyaluronate were used in this study. For nerve hydrodissection, the most common regimen was 0.9% saline and 5% dextrose. Triamcinolone and lidocaine were used when the treatment combined trigger point injection, nerve blockade, and nerve hydrodissection at the same time. SASD bursa injection was performed using a 25G 38-mm needle by in-plane lateral-to-medial approach.[11] A combination of 10 mg triamcinolone and 5 mL of 1% lidocaine was a common regimen.

Results

Of the 806 US-guided interventions performed during the time interval encompassed in this study, 182 (23%) were excluded as there were no clearly defined patient responses, and 19 (2%) were excluded because the interventions were Botox injections. Therefore, the data of 605 (75%) US-guided interventions were analyzed in this study.

Table 1 shows the demographic and clinical characteristics of the study patients. Among the 605 US-guided interventions, 263 (43%) were performed on males. Regarding the primary complaint of the patient, 461 (76%) were performed due to pain as the only symptom, 27 (4%) were performed for numbness as the only symptom, 17 (3%) were performed for tightness as the only symptom, and 100 (17%) were performed for combined symptoms or others. Two cases of dizziness that resolved spontaneously within 10 min and one case of focal bruise at the injection site were reported. Neither severe systemic adverse events nor septic complications were reported.

The positive response rates among the different histological types of the tissue are presented in Table 2. Regarding the histological types, positive responses were observed in 83% of the interventions which were performed on the joint ($n = 162$), 73% for the tendon and the ligament ($n = 143$), 82% for the muscle and the fascia ($n = 294$), and 88% for the bursa ($n = 57$).

In terms of the different procedures, positive responses were observed in 83% for trigger point injections ($n = 244$), 70% for prolotherapy ($n = 103$), 83% for intra-articular injections ($n = 166$), 78% for nerve hydrodissection ($n = 69$), and 86% for SASD bursa injections ($n = 50$) [Table 2].

Discussion

This study showed that there was a significant improvement in symptoms in the patients, with the rate of positive responses being 81% among all the US-guided interventions. In addition, there were no major complications such as infection and severe allergic responses, with only mild temporary symptoms such as dizziness and focal bruise at the injection site. These results derived from real-world data indicate that US-guided intervention is a safe and effective treatment of choice in clinical practice.

Of all the histological type injections performed in this study, the bursa injection resulted in the highest positive response rate of 88%. Moreover, the positive response rate of SASD bursa injection in our study had improved from 77% (17 of 22 injections) in 2017 to 93% (26 of 28 injections) in 2018. This improvement might be attributable to several factors, including better patient selection and advancements of the injection technique.

Hypertonic dextrose injection resulted in the lowest positive response rate of 70% in all categories. This is not a satisfying

Table 1: Demographics and clinical information

Demographic factor	mean±SD (range)
Age (years old), mean±SD (range)	57±14.3 (18-97)
Gender	*n* (%)
Male	263 (43)
Female	342 (57)
Primary complaint	*n* (%)
Pain only	461 (76)
Numbness only	27 (4)
Tightness only	17 (3)
Combined or other complaints	100 (17)

SD: Standard deviation

Table 2: Effectiveness of ultrasonography-guided interventions

Variable	Total	Positive response (%)
Total	605	81
Gender		
Male	263	81
Female	342	80
Chief complaint		
Combined or other complaints	100	83
Pain only	461	81
Tightness only	17	76
Numbness only	27	70
Histological type		
Bursa	57	88
Joint	162	83
Muscle and fascia	294	82
Tendon and ligament	143	73
Procedure		
SASD bursa injection	50	86
Trp injection	244	84
IA injection	166	83
Nerve hydrodissection	69	78
Hypertonic dextrose injection	103	70

Trp: Trigger point, IA: Intra-articular, SASD: Subacromial-subdeltoid

result because most of the outcomes in other studies of hypertonic dextrose injection have been reported to be >80% of the positive response.[12] This might be associated with the analytic method used in this study. Hypertonic dextrose injection commonly consists of multiple injections performed every 2–6 weeks over the course of several months for treating the inflammation and resulting in tissue healing response.[12] However, this study has reported the patient's response of each intervention, which might decrease the positive response because of incomplete treatment course. When all the first injections in the treatment course were excluded, the positive response rate increased to 74% (58 of 78 injections), and when all the first and the second injections in the treatment course were excluded, the positive response rate increased to 79% (22 of 28 injections). However, the response to every injection still matters because it may influence the adherence of the patient and the motivation of the patient to complete all the treatment sessions. It is important to ensure that the patient understands the treatment planning and the long-term benefit to achieve a better rehabilitation outcome.

There are several limitations in this study. First, there were 23% of procedures without clearly documented patient responses. The positive response rate may be either underestimated or overestimated. Second, drug dosage and injection volume were adjusted according to the response of the patient instead of using standardized dose in every injection. Third, as this study primarily focused on US-guided interventions for pain control, the criteria for the positive response were purely defined based on subjective statements of the patient. There was no objective measurement of strength, range of motion, or quantitative change before and after the US-guided intervention. Therefore, the functional benefit of US-guided intervention might be neglected.

Conclusion

A positive response rate of 81% was observed in this study for all US-guided interventions. This real-world analysis demonstrated the effectiveness of various US-guided interventions without serious complications. We recommend US as a useful guidance for a variety of injections.

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Conflicts of interest

There are no conflicts of interest.

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