Post-operative outcomes following the excision of dorsal wrist ganglions with/without the use of methylene blue

Suleyman Tas¹, Rustu Kose¹, Ahmet Sen², Sabri Balik³

ABSTRACT

Objective: To compare the success and recurrence rates of surgical excision of the dorsal wrist ganglions depending on methylene blue injection usage.

Methods: Dorsal wrist ganglions of a total of 64 patients were excised between the years 2009 and 2014. All procedures were open surgical excisions and were performed under regional intravenous anaesthesia and tourniquet. Patients were randomly allocated to the use of methylene blue during surgery. In group 1 (n=32), 0.2 mL of 1% methylene blue solution was injected into each cyst before excision. In group 2 (n=32), cysts were treated as in group 1, but methylene blue was not utilized. The Chi-square test was employed for statistical analysis.

Results: Patients were followed up for a mean of 2 years. All patients were satisfied with the aesthetic outcomes and status of the scars. In group 1, recurrence was not observed. In five patients of group 2, the cysts ruptured intraoperatively. In these patients, recurrence was observed postoperatively. The difference between the success rates of the two groups was statistically significant (P = 0.02). Methylene blue-related complications were not observed in patients.

Conclusions: The recurrence of cysts is rare after complete excision, particularly when rupture is prevented. Methylene blue injection is useful for ensuring complete excision and, therefore, to prevent recurrence.

Key words: Ganglion cyst, methylene blue, surgical excision, recurrence

Introduction

Ganglion cysts are the most commonly seen local masses of the hand and the wrist. These cysts generally originate from the synovium, tendons, or the tendon sheets. Dorsal wrist and scapho-lunate ligaments are the most common sites of occurrence (60–76%). Although the factors contributing to the development of ganglions are not fully understood, they are frequently seen as acute occupational cases or because of recurrent chronic injuries [1]. Ganglions are typically seen in the second and sixth decades of life and are more frequent among women. Although the average size reported is 3 cm in diameter, a ganglion cyst measuring 10 cm has also been observed [2].

Diagnosis of ganglion cysts is usually straightforward and based on a combination of characteristic clinical history and findings from the physical examination. Dorsal wrist ganglions are firm, smooth and round-
shaped and do not pulsate. They are trans-illuminated if not deeply located and very small. Further, the cysts are multilocular and irregular and may contain a yellowish fibery jelly fluid common to all ganglions [2].

Ganglions are usually asymptomatic and, therefore, are not treated. The most common complaints are cosmetic disturbance, pain, weakness and limited wrist motion. Frequently, a mild disturbance may be present before noticing the mass [3]. Various strategies, including observation, aspiration, sclerotherapy and surgical excision (either open or arthroscopic) are put to use in the treatment of ganglions. Spontaneous recovery is reported in 40% of cases [3,4]. Recurrence of the mass is the most familiar complication after treatment [1–5]. In the past, various methods were adopted in an attempt to reduce recurrence rates. Higher success and reduced rates of complications are reported with arthroscopic excision after injecting methylene blue (MB) [3].

In this study, the efficiency of MB on an open surgical excision, the preferred technique in dorsal wrist ganglions, was investigated and the aim was to compare the success and recurrence rates depending on MB injection usage retrospectively.

Materials and Method

This work was designed as a retrospective study and approved by the Medical School Ethics Committee of R.T.E University (approval no: 135). Written informed consent was obtained from all patients after they were informed of the treatment and potential side effects. Symptomatic patients (intractable pain, weakness or limitation in the range of the wrist) were subjected to surgery. Preoperative information regarding the patients is summarized in Table 1, and the data were obtained from medical charts. Dorsal wrist ganglions in a total of 64 patients (44 women, 20 men), aged 15–57 years (mean = 28 years) were excised between the years 2009 and 2014. All surgeries were performed by three fully skilled specialists (2 plastic surgeons and 1 orthopaedic surgeon). Ten had recurrent cysts that had been excised before at various institutions. Of the cysts, 38 were on the left side and 26 were on the right. The size of the cysts were measured between 1.5 cm x 1.2 cm and 4.5 cm x 4.0 cm (mean = 2.8 cm x 3.0 cm). The patients were divided into two groups according to the use of MB during surgery. In group 1 (32 patients, aged 20–54 years, mean = 26 years), 0.2 mL of MB was injected into each cyst. The cysts were then resected from neighbouring tissue with its stalk under full view in a bloodless operative field, and the joint capsule was repaired with 2-0 vicryl. In group 2 (32 patients, aged 15–57 years, mean = 29 years), cysts were treated just as in group 1, but MB was not employed. Patients were followed up at 6 month intervals for a mean of 24 months (range from 12 to 36 months). Success was identified for cosmetic problems by palpation at the dorsum of the wrist in a flexed position by a plastic surgeon in a blind fashion, for intractable pain by the visual analogue scale (VAS, 0-10) to determine the pre- and postoperative pain level, and for weakness and limitation in the range of the wrist by measuring the range of grip strength and motion. The procedure was considered successful if no lump was detected cosmetically, if VAS was between 0-2 for pain, and if the wrist did not have limitations or weakness. The success rate, size, side and presenting symptoms in each group were compared using the Chi-square test. P < 0.05 was considered statistically significant.

### Surgical technique

Location of the lesions and incision sites were marked preoperatively (Figure 1). All procedures were

| Table 1. Preoperative information of the patients is summarized. The size, side and presenting symptoms of the ganglions in the two groups were not significantly different (Chi-square test). |
|---------------------------------|-------|-------|--------|
| Number of patients              | Group 1 | Group 2 | p value |
| Mean age                        | 28.4   | 27.6   |         |
| Male/Female                     | 1/2    | 1/2    |         |
| Side of the ganglion            |        |        | 0.610   |
| Right                           | 12     | 14     |         |
| Left                            | 20     | 18     |         |
| Symptoms                        |        |        |         |
| Intractable pain                | 21     | 19     |         |
| Weakness/limitation in range of wrist | 10     | 11     | 0.786   |
| Cosmetic                        | 1      | 2      |         |
| Size of the ganglion            |        |        | 0.622   |
| 0-1 cm                          | 0      | 0      |         |
| 1-3 cm                          | 20     | 18     |         |
| >3 cm                           | 12     | 14     |         |
| Recurrent case/Primary case     | 5/27   | 5/27   |         |
Excision of dorsal wrist ganglions

performed under regional intravenous anaesthesia (RIVA) with the help of a tourniquet. In group 1, 0.2 mL of 1% MB (ADR®, Istanbul, Turkey) was injected into each cyst using a 32-G needle (Figure 2). After 5–7 min, surgery began. Cysts were fully resected from neighbouring tissue with their stalk under full view in a bloodless operative field (Figure 3). The joint capsule was then sutured with 2-0 vicryl (Figure 4). Visible vessels were cauterized. In all cases, the skin incision was closed intracutaneously with 4/0 PDS. A drain was not used. The wrist was splinted for one week. A bandage was applied for one week after the splint was removed. Patients were allowed to return to their daily activities on the 7th postoperative day. In group 2, a similar procedure was employed, but MB was not utilized.

Results

Patients were followed up for a mean of two years. The size, side and presenting symptoms of the ganglions in the two groups were not significantly different (Table 1). Primary wound healing occurred in all incisions. Hypertrophic or painful scarring from any of the incisions was not encountered (Figure 5). In group 1, cysts were fully removed without rupture and no recurrence observed and no revision was required (0% recurrence rate, Table 2). In five patients of group 2, the cysts had ruptured and recurrence was seen postop-
As is best presently known, this is the first comprehensive report describing the positive long-term post-operative outcomes of dorsal wrist ganglion procedures performed with the help of MB. The rates of ganglion rupture and its impact on post-operative outcomes have not been described in any earlier reports. In this work, it was found that recurrence of the lesions was closely related to rupture of the ganglion. It is likely that ganglion rupture leads to their incomplete excision.

Nelson et al. [12] described a cure rate of 94% in cases where cysts were removed under general anaesthesia or axillary block. The cure rate is about 65% when the cysts are removed under local anaesthesia and tourniquet [13]. Here, all procedures were performed using regional intravenous anaesthesia (RIVA) and application of a tourniquet. Although RIVA was utilized, these surgeries were considered being performed with axillary block, in which the effect of anaesthesia continues after the tourniquet is released, probably more effective.

MB has multiple medical applications from surgical marking pens to methemoglobinemia treatment [3,13]. In cancer surgeries, 3–5 mL of MB is applied to identify sentinel lymph nodes [14]. In these cases, skin necrosis rates of 1.25% to 21% have been documented. However, in the present study, 0.2 mL of 1% MB was used and care taken to ensure that MB is restricted to the ganglion. Additionally, it has been reported that when MB is administered intravenously in large amounts, it may cause hemolytic anaemia in patients with G6PD deficiency [15]. Yet, in the small volume of MB injection injected into the cysts with this work, the risk is minimal [3,13]. Moreover, no complications, including anaemia and skin necrosis, were encountered in any of these patients.

As such, the use of a dye that would allow surgeons to follow the stalk through to the pedicle and would facilitate the complete removal of the ganglion, avoiding excision of the periganglionar structure such as a portion of the joint capsule or the scapho-lunate ligament. In the presented study, the positive long-term benefits of using MB in wrist ganglion procedures are shown. Although ganglion rupture in group 1 (MB group) did not take place, it is possible that had rupture occurred, it may have caused a complete blackout in the operative field.

### Table 2. The results of the treatments. The success rates of the two groups were significantly different (P = 0.02).

|       | Recurrence | Success | Total |
|-------|------------|---------|-------|
| Group 1 | 0          | 32      | 32    |
| Group 2 | 5          | 27      | 32    |
| Total  | 5          | 59      | 64    |

eratively in all of these patients (15% recurrence rate). Two of the recurrent 5 patients had a mild pain (VAS, 4-5), one had a small limitation in wrist flexion (8°) and the remaining 2 had a palpable mass (1-3 cm). The success rates between the two groups were significantly different (P = 0.02). All patients were satisfied with the outcomes. MB-related complications were not seen.

**Discussion**

Ganglion cysts are benign masses, typically located near the tendon, tendon sheath and joint capsule. Their origin is uncertain. However, they are likely caused by myxoid degeneration of the fibrous tissue of the capsule, ligament and retinacula [6]. Although the extra-capsular portion of the ganglion is the main palpable mass, an intra-capsular part is also present, including the stalk of the cyst. Angelides and Wallace [7] studied 500 cases and reported that there is a tortuous duct between the main cyst and the scapho-lunate joint.

The recurrence rate appears to be controversial, varying from 0% to 30% in the literature [7,8]. These results appear to have been influenced by the fact that the pedicle of the ganglion was not found [9–11]. Even in arthroscopic excision of dorsal wrist ganglions, the primary complication is recurrence, likely a consequence of insufficient debridement of the ganglion stalk [3].

As such, the use of a dye that would allow surgeons to follow the stalk through to the pedicle and would facilitate the complete removal of the ganglion, avoiding excision of the periganglionar structure such as a portion of the joint capsule or the scapho-lunate ligament. In the presented study, the positive long-term benefits of using MB in wrist ganglion procedures are shown. Although ganglion rupture in group 1 (MB group) did not take place, it is possible that had rupture occurred, it may have caused a complete blackout in the operative field.
with 2-0 vicryl and the wrist immobilized for 7 days. Although sutureing the joint capsule is likely to diminish recurrence rate, this is yet to be verified. Finsen et al. [18] reviewed 122 independent cases of wrist (82 dorsal, 40 volar) ganglion procedures, the majority of which were performed by general or inexperienced orthopaedic surgeons, noting that there were two cases of recurrence among a total of eight patients whose ganglions were excised and capsules sutured.

Surgical treatment of the ganglions may be associated with complications, like nerve injury, scarring, post-operative joint stiffness, scapho-lunate ligament instability and recurrence. No such complications were encountered here, except recurrence in group 2. However, the follow-up period of the patients was 2 years and so this may be a limitation of the study. Overall, there is still much to learn in order to maximize the benefits of MB.

Conclusion
Recurrence rate is low when cyst excision is performed in full view in a bloodless operative field. It was observed that injecting MB into the cyst enables better visualization of the borders and the stalk, thereby preventing intraoperative rupture. The rates of incomplete excision and recurrence increase with rupture during excision. However, recurrence is rare after complete excision. Ultimately, MB is useful in dorsal wrist ganglion cyst surgery as it assists in the complete excision of cysts without rupture.

Conflict of Interest
The authors declare that they have no conflicts of interest, commercial associations, or intent of financial gain through this research. This study was approved by the Medical School Ethics Committee of R.T.E University (approval no: 135). Written informed consent was obtained from all patients.

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