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How I do it

## Para-testicular injection of indocyanine green for laparoscopic immunofluorescence-guided lymphatic-sparing Palomo procedure: Promising preliminary results

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#### Summary

Lymphatic-sparing Palomo procedure with intra-testicular injection of indocyanine green (ICG) has shown good results but the injection might harm the testes. This article describes the results of twelve consecutive patients where visualization and sparing were carried out successfully with para-testicular injection of ICG. Procedural details are reported thoroughly.

#### Introduction

Varicoceles are a common urological anomaly in the adolescent male. Due to lack of comparable data, it is currently impossible to determine the best treatment modality [1], but evidence suggests, that the laparoscopic lymphatic-sparing Palomo procedure and the microsurgical subinguinal lymphatic-sparing approach are associated with the best results [2]. Lymphatic-sparing with the application of indocyanine green (ICG) has been promoted as an effective technique without the risk of permanently staining the scrotal skin. Esposito et al. published their experience with intra-testicular injection of ICG and reported 100% of visualization of the lymphatic vessels and very few detectable intratesticular lesions [3]. Para-testicular injection has been done with Isovulphane blue in the past but is linked to a lower rate of lymphatics visualization [4]. We hypothesized that para-testicular injection of ICG leads to successful mapping without the risk of adverse effects.

#### How I do IT: Method and results

Laparoscopic lymphatic-sparing Palomo procedure (ligation of the testicular artery and veins) with para-testicular injection of ICG was

Early experience shows convincing results, we believe that para-testicular injection leads to equally good visualization of testicular lymphatic vessels without the risk of testicular lesions. We will continue to use para-testicular injection and encourage others to do so to increase the amount of available data, allowing for evidence-based result in the future.

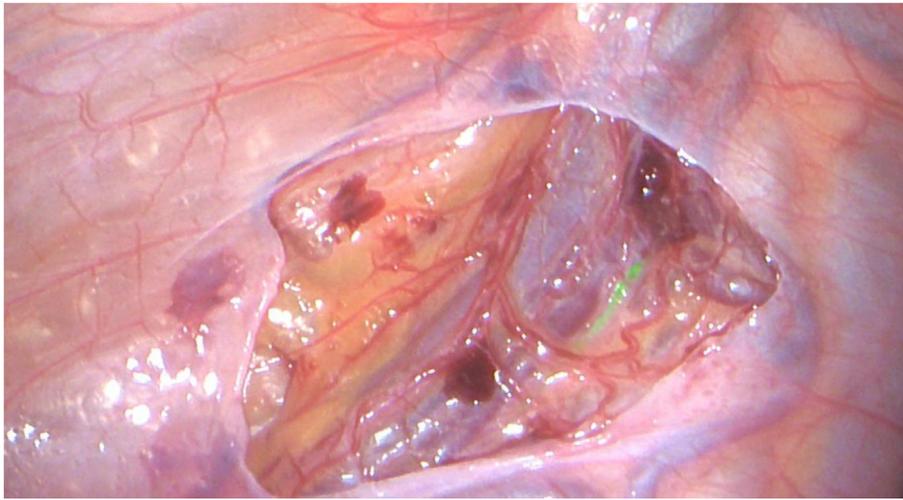
carried out in twelve consecutive patients between July 2022 and February 2024. Indications to operate was third degree, left-sided varicocele with a testicular volume difference exceeding 20% in all cases. Pre- and post-operative assessment was done clinically and with ultrasound. Median patient age was 14.2 years (range 7.9–16.6 years). Median testicular volume difference was 29% (range 22–42%).

Laparoscopy was installed with a Hasson mini laparotomy [5] at the umbilicus and a 5 mm camera port was inserted. Two working ports were inserted in the lower right quadrant and to the left of the umbilicus. Once access to the testicular vessels was assured, the ICG was injected. For this, the content of a 25 mg ICG ampulla was diluted with 8 ml of aqua. 2 ml of this solution (6.25 mg ICG) were then injected para-testicularly at three locations. The surgeon held the testis in one hand, punctured the skin with a 24-gauge needle once and moved the needle subcutaneously to three locations and injected approximately 1/3 of the fluid at each location.

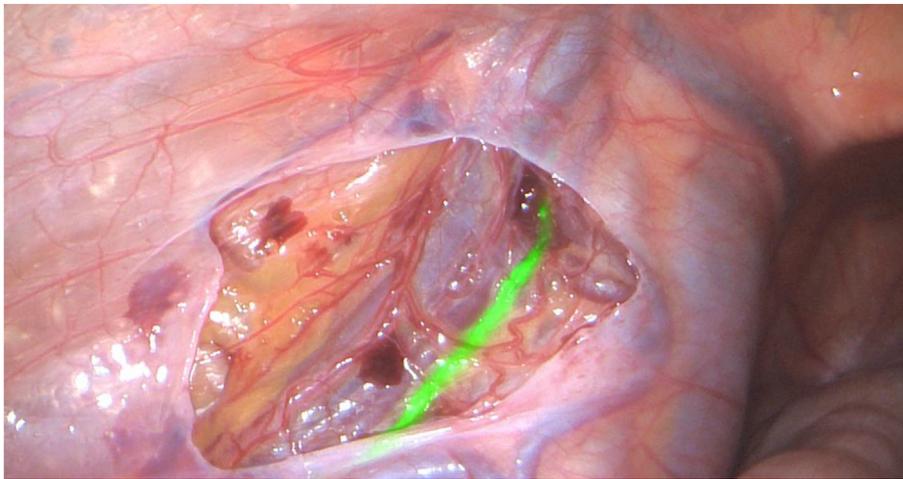
The spermatic vessels need to be observed carefully from the time of the injection on as the visualization might appear right after injection. It might take up to 30 s until the dye becomes visible; the beginning of the visualization is best noticed if the camera is brought close to the tissue (Figs. 1 and 2). If no

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**Fig. 1** Early visualization.



**Fig. 2** Lymphatic vessels before dissection.

visualization occurs within 30 s or to speed up the process, the testis might be massaged gently.

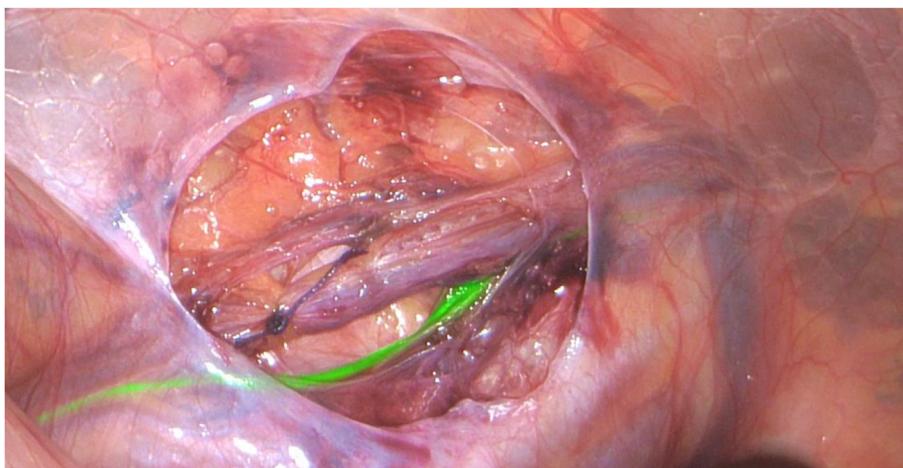
Visualization with ICG occurs much faster than with Isosulfan blue and with time, the whole surgical field turns green due to a distributive effect of the ICG. It is therefore key, to install laparoscopy before injection of the ICG.

Of our twelve consecutive patients, seven patients showed prompt visualization, four patients showed it within 30 s and in one case, massage of the testes was carried out. Either two or three lymphatic vessels became visible.

The peritoneum was then opened above the testicular vessels with scissors, the lymphatic vessels were bluntly dissected from the testicular vessels and the vessels suture-ligated and divided (Fig. 3).

There were no intraoperative complications. One patient briefly showed a staining of the scrotal skin. As ICG is photosensitive, there is no risk of permanent staining.

Nine patients were seen after three months (three pending): there were no varicoceles persisting, and no postoperative hydroceles. All testes were vital and had grown significantly since the procedure.



**Fig. 3** After dissection, one ligation placed.

## Conclusion

Sparing the lymphatic vessels with the use of ICG-immunofluorescence-guided technique was successful in twelve consecutive patients. Longer follow-up and a bigger cohort are needed to verify results, but these early findings are promising. Our preliminary results show that paratesticular injection of ICG results in equally good visualization of testicular lymph vessels, therefore intratesticular injection should be avoided to reduce any harm to the testes.

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