

Peroperative identification of parathyroid gland using methylene blue

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(Received 4 / 2 /2014 , Accepted 17 / 3 / 2014)

الخلاصة:

ان تمييز غدة الدرقية خلال عملية رفع تضخم الغدة الدرقية عادة يقلل خطر قصور غدة الدرقية بعد العملية. ان هذه الدراسة حللت (مستقبلية) خمسين مريض (10 ذكور و40 اناث) وكانت اعمارهم تتراوح ما بين (20- 70 سنة) كانوا يعانون من اسباب مختلفة لتضخم الغدة الدرقية اجريت لهم عملية رفع الغدة الدرقية في قسم الجراحة العامة في مستشفى الديوانية التعليمي للفترة بين شهر ايار لسنة 2008 الى ايلول لسنة 2010. ان اعتماد صبغة المثلين الزرقاء بواسطة حقنها في الشريان الدرقي السفلي بتركيز 0,5% و بكمية حوالي واحد ميليلتر كأسلوب في تمييز غدة الدرقية لمرضى يعانون من اسباب مختلفة لتضخم الغدة الدرقية اجريت لهم عملية رفع الغدة الدرقية. وقد اظهرت الدراسة بان بالإمكان تمييز غدة الدرقية بنسبة 85% بدون اي اعراض جانبية. ونحن من خلال هذه الدراسة المستقبلية استنتجنا بان تمييز غدة الدرقية اثناء العملية باستخدام صبغة المثلين الزرقاء هي طريقه فعاله وتسرع من عملية تمييز غدة الدرقية اثناء العملية.

Abstract:

Identification of the parathyroid gland during surgery of thyroid reduce the risk of postoperative hypoparathyroidism; as well as of great importance for identification of the parathyroid glands in parathyroid disease.

It is a prospective study conducted on (50 patient 10 male and 40 female) with various causes of goiter, who underwent operation in the the Surgical Department of the AL-DIWANYIA TEACHING HOSPITAL for the period between May 2008 to September 2010.

The technique of methylene blue dye injection through the inferior thyroid artery using one CC methylene blue 0.5% to recognize the parathyroid gland in patient suffering from various causes of thyroid disease and undergoing thyroid gland surgery.

The precise localization of the gland was possible in 85% . There were no adverse effect from this technique.

We conclude that peroperative identification of parathyroid gland using methylene blue is valuable technique that facilitates identification of the gland at operation.

Introduction:

The parathyroid glands are important to be localized for two reason

1.For patient with parathyroid disease the exact localization and the number of parathyroid gland in the neck and mediastinum is important for the management of the condition

2.During thyroid surgery, which is fairly common procedure, the parathyroid gland should be well localized to prevent removal or injury. There is no satisfactory replacement for endogenously produced parathyroid hormone, and the patient with hypoparathyroidism is doomed to a lifelong process of episodic, symptomatic

hypocalcemia despite calcium and vitamin D therapy .(1) The first description of the parathyroid gland in human beings was that by Ivan Sandstorm a medical student in Uppsala, Sweden in 1880 .(2)The parathyroid gland develop at about the fifth week of gestation,

The upper parathyroid gland arise from the dorsal aspect of the fourth branchial pouch.(3)

The lower parathyroid develop from the dorsal part of the third branchial pouches along with thymus(4) .

85-95% of individual have four parathyroid gland. The average parathyroid gland weight from 40 –70 mg .Vary in color from light yellow to a reddish brown , and the consistency is usually soft and pliable. Parathyroid gland differ in size and shape; 83% are oval or bean shaped, while the other elongated or bilobated or very rarely multilobated. This knowledge of shape is critical to operating surgeon, who must meticulously dissect the entire abnormal gland without fracturing it(5) .

The superior parathyroid gland are more constant in position than the lower. 80% are found on posterolateral aspect of the thyroid, immediately above the termination of the inferior thyroid artery. The inferior parathyroid gland are more variable in position 40% are found at lower pole of thyroid. 40% are within thymic gland and remaining 20% are variable site. Thus the lower gland may

be found anywhere from angle of jaw to pericardium(6).

Each gland has a delicate capsule & is supplied by a single leash of blood vessel clearly seen running in the subcapsular plane.Is derived mainly from the inferior thyroid artery, arising from the thyrocervical trunk of the subclavian artery(7).

The methylene blue is a cationic thiazine dye with chemical name tetramethylthioninechloride. The methylene blue has been widely used in a variety of clinical settings to identify anatomic and pathologic structures(for example identification of parathyroid gland by intravenous infusion of methylene blue dye), and to treat methemoglobinemia. It has also been used to inactivate viruses in fresh frozen plasma , to treat chronic periodontitis , and , experimentally , to treat septic shock(8,9).

Localization of the parathyroid glands is often a challenge even to experienced surgeons , because the anatomical variation in number , size , position , shape , and color complicate the preoperative and intraoperative localization of parathyroid glands.

There is various techniques for preoperative localization such as arteriography , selective venous catheterization , thallium and technetium scanning , ultrasound , computed tomographic scanning , nuclear magnetic resonance , and endosonography have been proposed as localization techniques

. However , the reliability of these studies varies to a great extent , and their predictive value is of little use to the endocrine surgeon (11) .Dudley (1971), who described parathyroid staining without serious complication in 17 patients after intravenous infusion of methylene blue(12). The explanation of that is the methylene blue dye is taken up preferentially in certain tissue of the body, these are the parathyroid, the heart, the pancreas, and the thyroid tissue with different rate of tissue clearance; this permit prolong searching of stained parathyroid while the color of thyroid has already return to normal. (13) The methylene blue dye taken up exclusively by oxiphyl cell of parathyroid gland and not interfere with histological staining. (14)

In our study we use small dose of methylene blue intraarterially (one milliter methylene blue 0.5%) through the inferior thyroid artery to avoid precaution and side effect of intravenous infusion of the dye which was used in the previous studies in large dose and concentration (5-10 mg / kg body weight of methylene blue 1%).

Patients and methods:

The sample of this randomized prospective study consist of 50 patients (10 male and 40 female) with various causes of goiters which include:

- . .35 patients with multinodular goiter , euthyroid , with pressure symptoms
- .6 patients with toxic multinodular goiters .
- . 6patients with solitary thyroid nodules .

..1patient with medullary carcinoma

.2 patients with Graves' disease . All underwent operation in the Surgical Department of the AL-Diwanyia Teaching Hospital for the period between May 2000 to September 2002. The patients age was range from 20 – 70 years and the mean age was 35.8. The patients were randomly selected , they were admitted to the hospital one day before the operation for thyroid surgery.

The technique:

.Inferior thyroid artery and recurrent laryngeal nerve identified.1

.2. Identification of parathyroid glands was looked for in the tissues surrounding the thyroid before staining depending on the natural position , consistency , mobility , vascularity of the glands , but most of all by it's natural color.

3.Two sling suture(2/0 black silk) put on the artery , one medially toward the gland and the other away from the gland.

4. 1milliter methylene blue 0.5% dye was administered to each patient directly to the inferior thyroid artery using syringe with a needle gauge 26 (insulin type of syringe).

5.After completeness of the injection the needle withdraw and the artery ligated in continuity medial and lateral to puncture hole.

6.Careful inspection of the thyroid and tissue surrounding it immediately after injection of the dye.

7.In doubtful cases part of the suspicious nodules send for histopathology.

Result: parathyroid gland when administered
The methylene blue dye injection intraarterially without any problem were
induced a dusky blue staining of the associated during injection.

The number of the patients in whom glands were identified before the staining is shown in table(1):

The number of patient that have been identified their gland	30
The number of patient that cannot identified their gland	20
Total number	50

The number of the patients in whom glands were identified after the staining is shown in table(2):

The number of patient that have been identified their gland	43
The number of patient that cannot identified their gland	7
Total number	50

The location of the parathyroid gland that were identified after staining is shown in table (3):

Location of gland	Number of the gland	%
Both upper and lower gland	23	53.4%
Only upper	13	30.2%
Only lower	7	16.2%

In about 15 patients the normal thyroid tissue stained with slightest tinge of blue ; in about 5 patients there was definite staining of the colloidal nodules and cysts.

The total number of patients in whom identification of the parathyroid gland was carried out before and after using the methylene blue injection was 48 patients (96%).

Discussion:

There is no simple , safe , and absolutely reliable method for preoperative localization of the parathyroid tissue (13).

An alternative approach to this problem of localizing parathyroid tissue is at operation the surgeon is aided by the natural position , consistency , mobility and vascularity of the glands , but most of all by it's natural color (13).

A dye technique which accentuate the characteristics and permits the gland to be visualised through several tissue layers , aid the surgical dissection (14).

On bases of these observation:

1. The percentage of patients that identified their glands before staining was 60%. In the rest the presence of the goiter and it's nodularity seem to hinder the identification of the parathyroid gland. In other words the presence of abnormal pathology in the thyroid in the case studied might be interfere with proper identification of the normal parathyroid glands.

2.After injection of the dye 86% of patients can be identified their glands in the following manner:

a.Both the upper and the lower glands identified in about 53.4%

b.Only the upper glands identified in about 30.2%

.Only the lower glands identified in about 16.2%

In the B&C the search for other gland was difficult because of goiter and it's nodularity hinder careful recognition of the parathyroid glands.

3.In the rest of the patients the parathyroid cannot be identified their glands; this might be due to:

a.Technical difficulties in 2 patients (4%) because of leak from the site of puncture at time of injection.

b. No tissue stain in 2 patients (4%).

c. Non specific because of higher nodularity of the thyroid gland; most of thyroid tissue has been stained and be confused With stained parathyroid gland in 3 patients (6%).

4.The normal thyroid tissue stain in 30% of cases with the slightest tinge of blue , this did not lead to difficulties in finding of the stain parathyroid gland.

5.In about 10% of the cases there was definite staining of colloid nodules and cysts , this lead to some difficulties in finding of the stain parathyroid gland.

6.In the patients with solitary thyroid nodules , medullary carcinoma of the thyroid , Graves' disease the identification of the parathyroid gland was easier than patients with multinodular goiter in both before and after the staining

Excellent result was obtain when surgeon depend on both :

a . The natural position , consistency , vascularity and the color

b. stainingtechnique.

comparism with other studies Is shown in the following table:

	Whlear and wade(1982) (15)	Elias –D(1983) (16)	Our study
No. of patient	90	59	50
Diagnosis	Primary hyperparathyroidism	Thyroid disease	Thyroid disease
Methylene blue route	I.V.route 1%	I.V. route	Intrararterial o.5%
Dose	5mg /kg B.W. in 500ml of 4.3% glucose&0.18% saline solution	5mg /kg B.W. in 500ml of 4.3% glucose&0.18% saline solution	1CC
Side effect	No side effect	No side effect	No side effect
% of stained gland	71%	87%	85%

Conclusion:

The use of methylene blue is quite essential for the identification of parathyroid pathology.

. In our study the percentage of parathyroid gland identification was 86% which is higher than other studies which use methylene blue intravenously in large doses and higher concentration.

The use of direct injection of methylene blue intraarterially using the inferior thyroid artery is to our knowledge hasn't been used before and no such method was recorded in the recent literatures.

. The use of intraarterial injection is done by much lower dose of methylene blue dye (0.5% - 1 milliiter), which has minimized the percentage of complication and unnecessary staining of other organ.

. Nearly all of seen cases are used on normal parathyroid glands during surgery for pathological thyroid glands, this might affect the accuracy of identification; while the other studies were all done on normal thyroid with abnormal parathyroid tissue.

Recommendation :

We recommend the use of these simple, safe, easy, and very accurate methods for identification of parathyroid gland in all cases of bilateral thyroid surgery and in carcinoma of the thyroid gland.

The use of this method in the future could give a better result of identification of pathological parathyroid gland especially if the thyroid gland is normal.

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