Negative outcomes of staged parathyroidectomy using percutaneous laser ablation

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Abstract: The article gives information about negative outcomes of staged parathyroidectomy using percutaneous laser ablation.

Keywords: primary hyperparathyroidism; parathyroidectomy; laser ablation; complications

Introduction. A feature of percutaneous ultrasound-controlled exposure to the parathyroid gland (PTG) is minimal trauma to the soft tissues of the neck and thyroid tissue. When performing such surgical treatment options for primary hyperparathyroidism (pHPT), various physical methods can be used to remove the altered PTG: laser ablation (LA), microwave ablation (MWA), radiofrequency ablation (RFA). If the selection criteria are met, contraindications are taken into account, and the technique is followed in conjunction with the use in a specialized center by specially trained personnel, patients tolerate these types of parathyroidectomy (PTE) well. Such PTE is necessarily preceded by a thorough topical diagnosis aimed at clarifying the size, location, structure and number of PTG. This is due to the fact that when performing PTE, negative side effects and complications may develop. However, specialists involved in percutaneous PTE using PLA, MVA or RFA indicate not only their effectiveness, but also safety [1] with extremely rare complications [2; 3]. Basically, the authors describe damage to the recurrent laryngeal nerve [4; 5], manifested by a slight cough and hoarseness of the voice. Similar complications according to Cao X-J. et al [6] occurs in 1.2% of cases. And also on the development of transient hypocalcemia [7]. There are no descriptions in the literature of cases of permanent or recurrent paralysis of the laryngeal nerve when performing PTE using percutaneous techniques for influencing the parathyroid gland.

Purpose of the study: improving the quality of surgical care for patients with pHPT

MATERIALS AND METHODS OF RESEARCH. Over the past 2 years (2021-2023), in the department of thyroid pathology of the Republican Scientific Research Center for Emergency Medicine in Samarkand, 69 patients with pHPT underwent staged PTE using PTA. Among them there were 5 (7.2%) men, 64 (92.8%) women. The presence of indications for surgical treatment was determined according to the Uzbek national clinical guidelines of 2021 [8]. Staged PTE was used as surgical treatment, which was accompanied by strict patient selection and consideration of contraindications [9]. Removal of the parathyroid gland when performing ultrasound-controlled step-by-step PTE involves performing several sessions of PTA, that is, step-by-step (in several sessions) removal of parathyroid adenoma. The diode medical laser “Lakhta-Milon” and “Lami” was used as a source. Staged ultrasound-controlled PTE was performed according to the original technique [10]. The number of sessions was determined individually (from 1 to 4). Ultrasound of the parathyroid gland and fine-needle aspiration puncture biopsy (FNA) of a formation suspicious for an altered parathyroid gland were used as diagnostics before performing a staged PTE. FNA/PTH was performed to determine the level of parathyroid hormone in the aspiration material. Confirmation of the presence and location of an altered PTG using ultrasound and FNA/PTG was an indispensable condition before performing a staged PTE. Visual control of the staged PTE was performed using an expert-level ultrasound device by a specially trained ultrasound physician. As laboratory diagnostics, we used determination of the level of parathyroid hormone (PTH) and onized calcium (Ca ++) [11].

RESEARCH RESULTS. In all operated patients, the diagnosis of PHPT was confirmed by laboratory parameters. The average PTH level in the blood before surgery was 379.3±29.3 pg/ml, the average Ca++ level was 1.43±0.11 mmol/l. In most cases (94.8%) hypercalcemia was detected, in 5.2% normocalcemia was detected. The bone form was identified in 69.2%, the visceral form in 15.4%, and the mixed form in 15.4%. When performing topical diagnostics, enlarged parathyroid glands were detected in the orthotopic position in 100% of patients. The localization of altered parathyroid glands has already been described by us [12]. The average dimensions of the parathyroid gland were: length - 18.5 ± 1.3 mm, width - 11.7 ± 0.09 mm, thickness - 8.8 ± 0.5 mm; average volume - 1.8±0.4 cm3. The average level of PTH in the aspiration material during FNA/PTH is presented in Table 1. In the postoperative period after staged PTE, normal levels of PTH and Ca++ were recorded in 89.86% of cases. We presented the results of laboratory diagnostics at the preoperative and postoperative stages in patients with effectively performed surgical treatment [12]. Target values of main laboratory parameters were achieved 1 month after surgery in 89.86%. In the long-term postoperative period, the values of these laboratory parameters also remained at the target level. And only in 10.14% an

unsatisfactory result was recorded with persistent elevated PTH levels and hypercalcemia. The unsatisfactory result in these patients was associated with the identification of another enlarged parathyroid gland of a different location (4 patients) and refusal to continue treatment, citing remaining normal laboratory values in another 3 patients. The first three patients underwent repeat staged PTE. The remaining three patients are under observation. The main negative effect of staged PTE using laser ablation was cervicalgia. In our patients, intraoperative cervicalgia occurred in 83% of cases. Moreover, in 94.5% of cases it self-limited within 2-15 minutes after completion of laser destruction. In the remaining 5.5% of patients, cervicalgia persisted in the postoperative period, for the relief of which NSAID tablets were used. Pain relief took from 1 to 3 days. Mild dysphonia as an undesirable effect was identified in 1.44%. This symptom resolved on its own, with complete restoration of the voice, 1 month after laser ablation.

Table 1.

Average PTH level in aspiration material

	N	Average	DI-95,000%	DI-95,000%	Min.	Max.	SOS
PTG	69	2832.23	1989.2	2871.1	642.5	5000.0	162.1

DISCUSSION OF RESEARCH RESULTS. The positive effect of staged PTE in the form of achieving the target level of PTH and Ca++ was detected in 89.86%. Such a high efficiency rate was achieved as a result, among other things, of strict patient selection and careful adherence to the methodology. Staged parathyroidectomy was not effective enough in only 10.14%. The lack of the required effect, associated with the detection of another PTG or with incomplete treatment (insufficient number of PLA sessions), was compensated by repeating the staged PTE. At the same time, the significant points that distinguish a staged PTE from a one-stage procedure (removal with a scalpel or video-assisted) are its implementation on an outpatient basis, without anesthesia and with the absence of any cosmetic defect. The high percentage of effectiveness of staged PTE using LA and the implementation of the technique in a specialized center does not exclude the occurrence of undesirable effects. In the literature, information about possible undesirable effects is extremely scarce, since the PTA PTG technique is not often used. This is also due to such positive aspects of its use as easy controllability and the application of pinpoint damage, dosage of exposure and variability of modes. According to experts [2; 13], most patients tolerate PLA well. If the technique is followed and the individual parameters of laser exposure are correctly selected, the patient’s sensations are associated with puncture of the parathyroid gland and the development of intraoperative and postoperative cervigalgia. It is believed that thermal painful stimuli are the leading ones in the pain spectrum. Minor pain from hot temperatures is first felt at a temperature in the skin of 43-47°C, and in the tissues

more than 50°C. Heating a large volume of tissue to “critical temperatures” (≥100°C) leads to increased pain. The more intense regimens used, the more powerful the pain response is expected to be. When the laser radiation is stopped, the pain stops in most cases [11]. An additional factor that maintains pain is the intense formation of steam during the destruction of the parathyroid tissue and its distribution under the thyroid capsule (if the needle passes through the thyroid tissue). Stretching of the thyroid capsule is accompanied by irritation of baroreceptors, which leads to local discomfort in the neck area from the intervention side. Discomfort is manifested by a feeling of fullness, pressure or a slight burning sensation at the site of laser exposure, a weak, aching, dull pain with possible irradiation to the lower jaw or teeth. In our patients, intraoperative cervicalgia occurred in 83% of cases. Moreover, in 94.5% of patients it self-limited within 2-15 minutes after completion of laser destruction. The remaining 5.5% of patients had postoperative cervicalgia, for the relief of which tablets from the NSAID group were used. Pain relief took from 1 to 3 days.The occurrence of intraoperative intense pain during gentle modes of the maxillofacial area indicates an incorrect location of the end of the light guide. This situation is associated in most cases with frequent swallowing by the patient, which leads to displacement of the end of the light guide too close to the gland capsule, or displacement of the needle into the lumen, which causes rapid heating of its metal part with irritation of the pain receptors of the gland capsule and skin. This situation can be stopped by stopping the supply of laser energy through the light guide and correcting the position of the needle and/or light guide. We believe that the occurrence of such situations is a technical issue in performing LA, which requires close intraoperative monitoring of the location of the light guide and needle. In patients with a low pain threshold, who reported the occurrence of intense pain already at the beginning of LA, provided that the light guide and needle were correctly positioned, we reduced the radiation power. This manipulation helped reduce the intensity of pain in the area affected by the laser. Transient paresis of the recurrent nerve on the side of manipulation, accompanied by mild dysphonia, usually associated with damage to the myelin sheath of the nerve under the influence of the temperature factor, according to a number of experts [2; 14] is completely resolved 3 months after LA. Among our patients, a similar undesirable effect was detected in 1.44% (1 patient), which resolved after 1 month with complete restoration of voice. With an increase in the duration of a PLA session with a large volume of tissue destruction, an increase in body temperature to subfebrile levels is possible in the postoperative period. The temperature may remain elevated for one to five days. This does not require special treatment or the use of antibacterial drugs. In our patients included in the study, no increase in body temperature was observed. Apparently, this is due to the absence of situations that required increasing the duration of the PLA session.usually associated with damage

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CONCLUSION. With its low invasiveness, staged PTE using PPA for pHPT is a method that requires careful selection of patients, scrupulousness and rigor in performing the surgical technique, methodicality and balance in the choice of PA modes. Only if these requirements are met in conjunction with implementation in a specialized center by specially trained personnel, the method can achieve high efficiency with a minimum number of undesirable effects and complications.

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