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The evaluation of simultaneous combined surgery of the heart and thyroid - own experience

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ABSTRACT

Background: Patients referred for cardiac surgery usually also have other comorbidities. These include thyroid disease, which is relatively common in patients with heart problems.

Objective: The aim of the study was to evaluate the feasibility of combined cardiac surgery and thyroidectomy.

Material and methods: Six patients (age range: 54-74 years) qualified for elective, simultaneous surgeries on the heart and the thyroid were included in the study. In preparation for thyroidectomy, three patients were diagnosed with diseases requiring cardiac surgery. Two patients, initially referred for coronary artery bypass surgery in one case, and surgery for recurrent fluid in the pericardial sac with concomitant mitral and tricuspid valve regurgitation and atrial fibrillation in the other, were diagnosed in large hyperactive goitre. The last patient with a history of oncology (lung tumour), admitted to the Department of Cardiology due to a heart attack, had a CT scan of the chest, which revealed retrosternal goitre narrowing the lumen of the trachea to 9 mm. All patients underwent combined heart and thyroid operation and were discharged home 8-27 days after surgery.

Conclusions: Although preoperative qualification requires a very cautious and individual approach, simultaneous surgeries in patients requiring thyroid and heart interventions are expedient and should be promoted.

Key words: surgery; heart; thyroid; thyroidectomy; cardiac patients.

INTRODUCTION

Patients referred for cardiac surgeries are generally burdened with numerous comorbidities. These are different forms of goitre, qualifying such patients also for thyroidectomy. Appropriate endocrine preparation - treatment of both hyperthyroidism and hypothyroidism enables safe performance of both cardiac surgery and thyroidectomy. We analysed several dozen simultaneous operations on the heart and thyroid available in the medical literature. Six patients were qualified for this type of surgery during. The aim of the

study was to assess the feasibility of simultaneous combined surgery of the heart and thyroid based on our experience.

MATERIAL AND METHOD

A retrospective study was conducted to compare own results of concurrent operations on the heart and the thyroid with the data available in literature. In eight years, 12 000 cardiac surgeries were performed at the Cardiac Surgery Clinic of Collegium Medicum in Bydgoszcz. At the same time, nearly 3 000 thyroidectomies were performed at the Department of General and Endocrine Surgery, CM UMK.

The study was conducted in accordance with the Declaration of Helsinki, and informed consent was obtained from all participants. It was also approved by the Bioethics Committee of the Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń. Six patients were qualified for elective, simultaneous surgeries. In preparation for thyroidectomy, 3 patients were diagnosed with the coexistence of diseases requiring cardiac surgery. Two patients were initially referred to the Department of Cardiac Surgery for coronary artery bypass surgery in one case, and surgery for recurrent fluid in the pericardial sac with concomitant mitral and tricuspid valve regurgitation and atrial fibrillation in the other. During the preoperative diagnosis, large hyperactive goitre was diagnosed in both patients. After endocrinological preparation (Thiamazol), the patients were returned to the Cardiac Surgery Clinic, where simultaneous surgeries were performed. The last patient was admitted to the Department of Cardiology for a heart attack. Due to a history of oncological disease (lung tumour), a CT scan of the chest was performed, which showed retrosternal goitre narrowing the lumen of the trachea to 9 mm.

After admission to the Department of Cardiac Surgery, the level of thyroid hormones was assessed in the patients in order to exclude hyper- or hypothyroidism. The level of calcium was determined and compared with the postoperative results by assessing the function of the parathyroid glands. Renal parameters were also monitored. A cardiac echo examination was performed.

In the operating theatre, patients were placed in a position enabling sternotomy with additional shoulder elevation facilitating access to the thyroid gland from the collar cut on the neck. A Swan-Ganz catheter was inserted, depending on the size of the gland, using access through the vein through the internal neck or the subclavian vein.

The sequence of operations was selected individually for the patient. In the case of coronary artery disease and goitre coexistence, coronary artery bypass grafting without extra

corporeal circulation (ECC), was performed first, and then, after ensuring proper blood supply to the heart, thyroidectomy. In the case of valve surgery, the thyroid gland was dissected first. Then, after securing the edges of the thyroidectomy wound with several subcutaneous sutures, a cardiac surgery was performed, finally the thyroid bed was re-examined and the wound was finally closed. This procedure enables quick access to the thyroid bed in the event of bleeding after heparin administration – necessary for cardiac surgery.

Subtotal excision was performed in 5 patients, and nearly complete excision of the thyroid gland in one patient, avoiding combining both a sternotomy incision with a collar incision (leaving a gap of about 3 to 4 cm) and a gland bed with a cardiosurgical field. A thin Redon tube was placed in the vicinity of the thyroid stumps to facilitate the localization of possible bleeding. In one case, due to haemostatic disorders, setons were introduced into the thyroid gland bed and removed on the second postoperative day.

After surgery, patients were transferred to the Department of Cardiac Anaesthesiology and Intensive Care, where they stayed for 2 to 8 days.

In patients with neutral goitre, Levothyroxine therapy was started on the first day after surgery, and in the case of preoperative hyperthyroidism, after laboratory tests were diagnosed with gland hypofunction.

Patient 1 (69 years old).

The patient with recurrent goitre was transferred to the Department of Cardiac Surgery due to aortic valve defect with a predominance of stenosis, shortness of breath after exertion (in NYHA class II heart failure - New York Heart Association), pain behind the sternum, dizziness. In 1971, the patient was operated at the 1st General Surgery Clinic of the Institute of Surgery in Poznań with a diagnosis of *struma adenomatosa*.

A thyroid ultrasound showed enlargement of both lobes. Right panel, dimensions: approx. 20x17x50mm. There were several heterogeneous nodules of various sizes in the flap. Left lobe was completely changed, with numerous heterogeneous nodules within it, with anechoic spaces.

Test results before surgery:

TSH- 0.1768 uIU / ml (n: 0.35-0.49); FT4 free thyroxine - 1.1 ng / dL (n: 0.7–1.48); free triiodothyronine FT3 - 3.29 pg / ml (n: 1.71 - 3.71).

Echocardiography: LVEF (left ventricular ejection fraction) - 69%, Mitral valve - narrow return wave (+). Aortic valve - massive calcification of the leaflets, calcification of the commissural and posterior ring. Maximum systolic gradient LV / Ao- 101, average -

61mmHg. Normal dimensions of the heart cavities. Left ventricular and septal muscle hypertrophy. No segmental disorders of contractility.

Coronary angiography: Without constrictions in the coronary vessels.

The simultaneous combined surgery included:

1. Subtotal removal of recurrent nodular goitre.
2. Implantation of a Hancock II 23mm biological aortic valve prosthesis.

Histopathological examination: *Struma colloidosa nodosa*.

The postoperative course was uneventful.

TSH - 3.5561 uIU / ml; FT4 - 0.8 ng / dL; FT3- 2.44 pg / ml

The patient was discharged home 8 days after surgery.

Patient 2 (74 years old).

The patient was admitted to the Department of General and Endocrine Surgery due to a feeling of breathlessness and pressure behind the sternum. Thyroid enlargement for several years and hyperthyroidism diagnosed 2 years earlier, treated with Metizol. Chest pains after walking 30-50 metres. Three years earlier the patient had suffered a non-Q myocardial infarction (anterolateral wall). Two years earlier the patient had undergone emergency cholecystectomy followed by another acute myocardial hypoxia (non-Q infarction - inferior wall) with circulatory and respiratory failure. In 4 years prior to surgery, the patient had been hospitalized 10 times due to attacks of atrial fibrillation and exacerbations of coronary artery disease.

Ultrasound examination of the thyroid revealed that the thyroid gland was completely enlarged, asymmetrical, behind the sternum, with a larger right lobe. Accurate measurements were impossible. The thyroid gland was completely nodular with scattered minor calcifications on the right side. The trachea displaced to the left. No enlarged lymph nodes were visualized. Lumpy goitre.

Test results before surgery:

TSH - 0.0018 uIU / ml; FT4 - 1.22 ng / dl, FT3 - 3.99 pg / ml;

TSH - 0.0285 uIU / ml, FT4 - 1.04 ng / dl, FT3 - 2.25 pg / ml.

Coronary angiography: LAD (anterior descending branch) - stenosis 75%, Cx (circumferential branch) - 50%, RCA (right trunk) - 95%.

Echocardiography: LVEF- 64%. Mitral valve- narrow return wave (+). Aortic valve - fibrosis and minor calcification of the petals. There are no segmental disorders of contractility.

The patient had been treated with Thiamazole for 2 years, and immediately before being transferred to the Department of Cardiac Surgery, Hydrocortisone was administered - 100 mg 2 times and Favistan one ampoule twice.

The simultaneous combined surgery included:

1. Bypass of the coronary arteries of the heart without ECC.

Arterial spans: LIMA (left internal thoracic artery) - LAD (anterior interventricular branch).

Venous spans: Ao - Marg II (marginal branch) and Ao - RDP (posterior interventricular branch).

2. Subtotal thyroidectomy.

Histopathological examination of the thyroid gland: *Struma colloidosa nodosa bilateralis*.

TSH (7 days after surgery) - 3.8578 uIU / ml, FT4 - 0.79 ng / dl, FT3 - 1.12 pg/ml

In the postoperative period, pharmacologically moderate atrial fibrillation occurred.

The patient was discharged home 10 days after surgery.

Patient 3 (65 years old).

The patient reported quick exhaustion, exercise dyspnoea, and pain behind the sternum; referred to the Department of Cardiac Surgery in euthyroidism after treatment with Thiamazol.

Test results before surgery:

TSH - 0.4665 uIU / ml; FT4 - 1.11 ng / ml; FT3 - 2.66 pg / ml.

Thyroid ultrasound showed the right thyroid lobe measuring 26x21x47 mm and the left thyroid lobe of 31x24x50mm. The width was 7mm. The thyroid was enlarged in both lobes, especially the left one. Within this lobe, there were 3 hypoechoic nodules, with a cystic degeneration of approx. 12mm, 15mm and 17mm. In the right lobe: numerous nodules of mixed echostructure with a diameter of 6mm, the largest measuring 17x8mm. The echostructure of the thyroid parenchyma was heterogeneous.

Echocardiography: LVEF - 69%. Mitral valve - leaflet fibrosis, central reflux wave reaches the top of the atrium (4+), reverse wave waist diameter 0.8 cm. Aortic valve - leaflet fibrosis, a wide return wave fills the entire outflow path of the left ventricle, reaches the level of papillary muscles (3+). Maximum LV / Ao- 30mmHg systolic gradient. There were no

segmental disorders of contractility. Enlarged left atrium and left ventricle. Left ventricular hypertrophy.

Coronary angiography: without constrictions in the coronary vessels.

The simultaneous combined surgery included:

1. Subtotal thyroidectomy.
2. Implantation of a biological aortic valve prosthesis (Hancock II 23mm);
Implantation of a biological mitral valve prosthesis (Hancock II 27mm).

Histopathological examination of the thyroid gland: *Struma colloidosa nodosa*.

In the postoperative course, renal parameters (creatinine 1.8 ng / dl, potassium concentration - 7.2 mmol / dl) increased, which normalized after pharmacological treatment.

TSH - 5.54 uIU / ml, FT4 - 0.95ng / dl, FT3 - 1.51pg / ml.

The patient was discharged home 10 days after surgery.

Patient 4 (54 years old).

The patient reported chest pain with little effort, CCSIII. A history of inferior myocardial infarction. The patient also suffered from hypertension and impaired glucose tolerance. During the previous hospitalization at the Department of Cardiac Surgery, overactive nodular goitre was diagnosed - cardiac surgery was postponed until euthyroidism was achieved (Thyrozol was implemented).

Test results before surgery:

TSH - 2.55uIU / ml; FT3- 2.99pg / ml; FT4- 0.7ng / dl.

Thyroid ultrasound revealed the right lobe of 31x30x75mm and the left lobe of 37x40x80mm. Isthmus of 8mm. Thyroid with heterogeneous echostructure, with numerous nodules. In the right lobe, the largest hypoechoic nodule in the lower pole, size 16x14mm and heterogeneous nodules with dimensions 9x6mm, 12x10mm and 15x12mm. In addition, the lobe contained calcification 10 mm wide. In the left lobe, the largest heterogeneous nodule in the lower pole of dimensions 37x34mm. In the upper pole of this lobe a nodule with calcification of size 15x12mm. Other heterogeneous nodules of dimensions 10x12mm, 18x13mm, 6x4mm.
Conclusions: nodular goitre.

Echocardiography: LVEF 70%. Correct valve structure and function, inferior wall hypokinesia. Normal total left ventricular systolic function.

Coronary angiography: LAD stenosis 100%.

The simultaneous combined surgery included:

1. Bypass of the coronary arteries of the heart without ECC.

Arterial spans: LIMA - LAD.

2. Partial removal of the thyroid gland.

Histopathological examination: *struma colloides nodosa glandulae thyroideae lateris sin.*
Struma colloides nodosa partim calcificans glandulae thyroideae lateris dex.

In the postoperative course, an increase in renal parameters (creatinine 1.5 mg / dl, potassium concentration 6.4 mmol / l) was observed, which disappeared after pharmacological treatment. Due to the increase in TSH levels and the reduction in FT3 and FT4 levels, substitution treatment was initiated. The patient was discharged home 8 days after surgery.

Patient 5 (74 years old).

The patient reported dyspnea on slight exertion, and the cardiac tamponade had been decompressed 3 times in the previous year. During the diagnosis of recurrent fluid in the pericardial sac, a CT scan revealed retrosternal goitre. Due to an overactive thyroid gland, the patient was prepared for the operation with Thiamazole. Additionally, the patient had type 2 diabetes.

Echocardiography: LVEF 46%. Severe mitral regurgitation, vena contr acta 1.2cm, LA 74mm, LV 61/48. Severe tricuspid regurgitation. Thickened pericardial plaques with fluid in the pericardial sac.

Coronary angiography: coronary vessels unchanged.

The simultaneous combined surgery included:

1. Almost complete thyroidectomy.
2. Releasing the pericardial sac from numerous adhesions, cleaning fluid spaces.
3. Plastic repair of the mitral valve with C-E Classic Annuloplasty Ring 36 .
4. Plastic repair of the tricuspid valve with Edwards MC3 Tricuspid Ring 36 .
5. Left atrial ablations. Saturation on the left atrium appendage.

Histopathological examination: *struma colloides parenchymatoso-nodosa glandulae thyroideae.*

Due to coagulation disorders occurring after surgery, closure of the chest was postponed till the next day. After the operation, the patient required intra-aortic counterpulsation (6 days) and infusion of catecholamines: epinephrine, norepinephrine. Due to the biochemical markers of hypothyroidism and parathyroidism, left thyroxine treatment and calcium supplementation were initiated.

Patient was discharged home 27 days after surgery.

Patient 6 (67 years old).

The patient admitted to the Department of Cardiology due to myocardial infarction without persistent ST segment elevation. After coronary angiography and echocardiography the patient was qualified for cardiac surgery. Coronary angiography: LAD prox 70-80%, Cx-100%, RCA 100%. Heart echo: LVEF 40%: akinesia of the apical and medial lateral segments and the apical segment of the inferior wall. Mitral valve moderate VC mitral regurgitation 0.5cm. Due to the past lobectomy of the right lung, a CT of the chest was performed, showing enlargement of the thyroid gland narrowing the lumen of the trachea to 9 mm.

TSH 0.35 μ IU / l (<N), FT3 3.09 μ g / ml (N), FT4 1.18 ng / dl (N). Patient prepared for surgery Favistan 40 mg (1-0-1) and Hydrocortisone 100 mg i.v. (1-0-1).

The simultaneous combined surgery included:

1. Bypass of the coronary arteries of the heart without ECC.

Arterial spans: LIMA - Diag - LAD.

Venous spans: Ao - RDP.

2. Partial removal of the thyroid gland.

Histopathological examination: *struma colloidis nodosa glandulae thyroideae*.

In the postoperative period, there was a slight decrease in calcium 1.92 mmol / l, which was normalized after the use of Calperos 2 x 1.0 g p.o. The patient was transferred to the Department of Cardiology on the 8th day after surgery (hospitalization extended for social and living reasons).

Table 1. Characteristics of the simultaneous combined surgery in each of the patients described.

Patient	Surgery time (min.)	ECC time (min.)	Aortic obstruction (min.)	Stay in the postoperative ward
1	390	96	70	3 days
2	400	-	-	4 days
3	355	125	97	3 days
4	315	-	-	2 days
5	510	133	80	8 days
6	345	-	-	2 days

ECC- extra corporeal circulation

DISCUSSION

The clinical manifestations of hyperthyroidism are diverse. They are considered depending on the patient's age, aetiology, severity and duration of hyperthyroidism. However, cardiovascular symptoms (from the first signs of "heartbeat" up to and including circulatory failure) are always analysed in the first place [6]. They are associated with an increase in resting metabolism, stroke volume and accelerated heart rate [13]. It is emphasized that even in subclinical hyperthyroidism there is a risk of atrial fibrillation [13].

Complications associated with hyperthyroidism in operated patients have been known since the first years of modern thyroid surgery. Charles Mayo introduced the concept of hyperthyroidism in 1907. The use of antithyroid drugs by Edwin Astwood in 1943 and radioiodine therapy a year earlier made surgery safer [15]. However, in untreated patients with hyperthyroidism who have other indications for emergency surgery, there is a possibility of a thyroid crisis. In these patients, warning against a breakthrough, safer methods of perioperative management are proposed [4].

Hypothyroidism also leads to decreased heart function, resulting from decreased stroke volume, prolonged diastolic time, slower action, and increased peripheral vascular resistance. It is associated with a decrease in the level of thyroid hormones in the blood, which interferes with the inotropic and chronotropic function of the heart. Many diseases not related to the thyroid gland change the serum levels of thyroid hormones and TSH (thyroid stimulating hormone). These deviations are greater the more severe the underlying disease and the worse the prognosis. Cardiac surgeons of several centres analysed the behaviour of thyroid hormones and TSH in large groups of patients they operated on. They unanimously agreed that after heart surgery, blood levels of thyroid hormones and TSH decrease proportionally to the severity of the surgical course. The use of ECC also contributes to lowering the level of thyroid hormones. The necessity of preoperative substitution treatment with thyroid hormones is also considered [2,3,14].

Preoperative endocrinological preparation of patients with concomitant goiter who are referred urgently for cardiac surgery requires special attention and can pose a big problem. The above-mentioned influence of hyperthyroidism on the heart muscle (increased oxygen demand) and hence the intensification of ischemic features, the possibility of supraventricular arrhythmia and tachycardia mean that in patients with hyperthyroidism who also require cardiac surgery, taking the risk of simultaneous combined procedures is justified [1]. The anatomical proximity of the thyroid gland to the heart, thanks to sternotomy, allows a convenient access to the thyroid gland in the case of large retrosternal goiter, which is also

considered beneficial. Another argument in favor of the discussed simultaneous surgeries is the growing number of people operated on both for thyroid and heart diseases from year to year. The introduction of preoperative thyroid function screening will increase the probability of qualification for these operations [20]. Also, the precise calculation of the costs of these measures seems to indicate the advisability of their promotion. It should be noted that our patients and those cited in the literature assessed these operations very well. The first simultaneous combined operations on the heart and thyroid gland was performed in the 1960s by Neimark. He performed 4 operations in cases of coexisting hyperthyroidism and mitral stenosis [10].

In the medical literature of recent years, reports of simultaneous combined operations on the heart and thyroid gland have been scarce. In 1994 Wolfhard et al. introduced 19 such operations, 14 of which were carefully analysed. These authors stressed that although the first description of a simultaneous operation of overactive goitre and mitral stenosis was known as early as 1971, combined operations on coronary and carotid arteries are performed much more frequently [16]. In 1994, aorto-coronary bypass surgery and excision of 4 parathyroid glands (primary hyperparathyroidism followed by ischemic heart disease) were performed [12].

In 2003, B. Abboud et al. presented 6 simultaneous procedures on the heart and thyroid between 1996 and 2003. During this period, 2 530 cardiac surgeries were performed, so the percentage of combined operations was 0.23% [1].

In 2005, Litmathe et al. presented a collective work on simultaneous thoracic-cardiac surgery and thyroidectomy (or parathyroidectomy). The material describes six patients who, apart from endocrine pathology, had coronary heart disease in three, and aortic valve defect, thymoma and non-Hodgkin's lymphoma in the remaining cases. One patient (after coronary artery bypass graft surgery + thyroidectomy) died in the immediate postoperative period due to complete heart failure, despite high doses of catecholamines, intra-aortic counterpulsation, retractorotomy and additional revascularization [7]. Also in 2005, a report by the same author was published regarding the successful simultaneous bypass of coronary arteries of the heart, reconstruction of the brachiocephalic trunk and subtotal thyroidectomy in a 61-year-old patient [8].

Case studies on simultaneous surgeries in patients with enormous retrosternal goiter have shown that the risk of surgery accumulation is reduced [17,18]. Technical difficulties of the operation of the retrosternal goiter may result from the operation in the scarred area in the case of two-stage operations [19].

Scientific reports indicate the safety of simultaneous operations on the thyroid gland and coronary artery bypass grafting, inclining at the same time to perform the operation without ECC. This is to reduce the amount of heparin administered - and thus reduce the risk of bleeding [21,22,23]

The undoubted downside of simultaneous surgeries is the duration of the procedure. In our case it took about 400 minutes (315-510 minutes) on average, so there is a possibility of excessive cooling of the patient or the occurrence of pressure ulcers. Thanks to the use of heating mattresses and the appropriate temperature the operating theatre, no such complications have been observed in our patients. The necessity of intra- and postoperative administration of heparin preparations and the resulting fear of hematomas in the thyroid bed, prolonged operation time, and the possibility of multiple complications prevent surgeons from performing these operations more frequently and more widely.

CONCLUSIONS

Although preoperative qualification to simultaneous operations in patients requiring thyroid and heart intervention requires a very cautious and individual approach in each case, we do believe that such surgeries are expedient and should be promoted.

Author's contribution:

Conceptualization: AG and WG;

methodology: AG and WG;

check: AG, WG, OJ, WP, LA, RJ;

formal analysis: AG, WG, OJ, WP, LA, RJ;

investigation: AG, WG, OJ;

resources: AG, WG, OJ, WP, LA, RJ;

data curation: AG;

writing - rough preparation: AG, WG, OJ,

writing - review and editing: WP, LA, RJ;

supervision: WG, LA, RJ.

All authors have read and agreed with the published version of the manuscript.

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REFERENCES

1. Abboud B, Sleilaty G, Asmar B, Jebara V. Interventions in heart and thyroid surgery: can they be safely combined? *Eur J Cardiothorac Surg.* 2003;24:712-15. doi:10.1016/S1010-7940(03)00411-1.
2. Cerillo AG, Sabatino L, Bevilacqua S, Farneti PA, Scarlattini M, Forini F, Glauber M. Nonthyroidal illness syndrome in off-pump coronary artery bypass grafting. *Ann Thorac Surg.* 2003; 75 : 82-7. doi: 10.1016/s0003-4975(02)03919-x.
3. Chu SH, Huang TS, Hsu RB, Wang SS, Wang CJ. Thyroid hormone changes after cardiovascular surgery and clinical implications. *Ann Thorac Surg.* 1991; 52:791-6. doi: 10.1016/0003-4975(91)91213-f.
4. Clark OH. Tarczycza i przytarczycze; Współczesne rozpoznanie i leczenie w chirurgii. red. Dunphy JE, Way LW, PZWL 1980r. t.1,275-6.
5. Jones TH, Hunter SM, Price A, Angelini GD. Should thyroid function be assessed before cardiopulmonary bypass operations? *Ann Thorac Surg.* 1994; 58 : 434 - 6. doi: 10.1016/0003-4975(94)92223-3.
6. Kohler PO; *Clinical Endocrinology*, A Wiley Medical Publication 1986r.; 92-5.
7. Litmathe J, Kurt M, Boeken U, Roehrborn A, Feindt P, Gams E. Combined cardiothoracic surgery and interventions of the para/thyroid gland. A rare clinical cooperation. *Z Kardiol.* 2005; 94 : 28 - 32. doi: 10.1007/s00392-005-0177-6.
8. Litmathe J, Kurt M, Grabitz K, Knoefel WT, Gams E. Simultaneous coronary artery bypass grafting, replacement of the innominate artery and subtotal thyroidectomy in a 61 year-old patient: a case-report. *Chin Med J* 2005; 20; 699-701. doi:10.21767/2254-6758.100105.
9. Matsuyama K, Ueda Y, Ogino H, Sugita T, Nishizawa J, Matsubayashi K, Yoshimura S, Yoshioka T, Tokuda Y. Combined cardiac surgery and total thyroidectomy: a case report. *Jpn Circ J.* 1999;63:1004-6. doi: 10.1253/jcj.63.1004.
10. Neimark II. Surgical features in the treatment of patients with both thyreotoxic goiter and mitral stenosis. *ProblEndokrinol* 1971;17:118-19.
11. Rudowski W, Tołłoczko T. *Chirurgia tarczycy; Chirurgia Kliniczna i Operacyjna*, red. Śliwiński M, Rudowski W; PZWL 1985r.,118.
12. Schafhalter-Zoppoth I, Eber B, Lax S, Wolf G, Grisold M, Aichbichler B, Dobnig H, Klein W. Coronary heart disease as the initial manifestation of primary hyperparathyroidism. *Wien KlinWochenschr.* 1994;106:527-30.

13. Smallridge RC. Disclosing subclinical thyroid disease. An approach to mild laboratory abnormalities and vague or absent symptoms. *Postgrad Med.* 2000;107:143-6,149-52. doi: 10.3810/pgm.2000.01.812.
14. Thrush DN, Austin D, Burdash N. Cardiopulmonary bypass temperature does not affect postoperative euthyroid sick syndrome? *Chest*1995;108:1541-5. doi: 10.1378/chest.108.6.1541.
15. Welbourn RB; *Historia Chirurgii Endokrynologicznej*, Wydawnictwo Akademii Medycznej w Gdańsku 1994r. str. 64-77.
16. Wolfhard U, Krause U, Walz MK, Lederbogen S.; *Chirurg.* Combined interventions in heart and thyroid surgery - an example of interdisciplinary cooperation 1994; 65: 1107-10.
17. Wexler S, Yamante K, Fisher KW, Diehl JT, Hirose H; Single-stage operation for giant substernal goiter with Severe coronary artery disease. *Ann Thorac Cardiovasc Surg* 2011; 17:524-7. doi: 10.5761/atcs.cr.10.01628.
18. Kocak N, Becit B, Erkut B, Kaygin M; Combined coronary arterial bypass graft and thyroidectomy in a patient with giant goiter: how reliable is it? *Thorac Cardiovasc Surg* 2007;55:53-64. doi: 10.1055/s-2006-924105.
19. Ducos C, Blaise H, Brichon P.-Y., Chavanon O, Chaffanjon P.-C.-J.; Indications for combined thyroidectomy and cardiac surgery. *J Visc Surg.* 2011;148(4):e321-2. doi: 10.1016/j.jviscsurg.2011.07.001.
20. Testini M, Poli E, Lardo D, Lissini G, Gurrado A, Scrascia G, Malvindi PG, Rubino G, Piccini G, de Luca Tupputi Schinosa L; Combined cardiac surgery and total Thyroidectomy: our experience of the literature. *Thorac Cardiovasc Surg* 2010;58:450-4. doi: 10.1055/s-0030-1249867.
21. Cetin E, Ozyuksel A, Dalbasi E. Single stage substernal thyroidectomy and off-pump coronary artery bypass grafting: is it worth using cardiopulmonary bypass unless absolutely necessary? *BMJ Case Rep.* 2014. doi: 10.1136/bcr-2013-201496.
22. Lampridis S, Chi Lau M, Mhandu P, Parissis H. Concomitant off-pump coronary artery bypass grafting and total thyroidectomy for a large retrosternal goiter: a case report and review of the literature. *J Thorac Dis.* 2016; 8(5): E362–8. doi: 10.21037/jtd.2016.03.33.
23. Mali S, Sarebanhassanabadi M. Combined Open-Heart Coronary Artery Bypass Surgery and Subtotal Thyroidectomy in 54-year-old patient: A Case Report. *Ethiop J Health Sci.* 2016 May;26(3):285-8. doi: 10.4314/ejhs.v26i3.11.