INPLASY

Factors influencing the intensity of parathyroid gland autofluorescence in near-infrared autofluorescence devices: a systematic review and meta-analysis

Corresponding author:
Marcin Adamiecki

marcinadam998@gmail.com

Author Affiliation:
Department of General and Oncologic Surgery, St. Joseph Hospital in Mikolow, Mikolow, Poland.

Adamiecki, M; Antkowiak, L; Antkowiak, R; Kasperczuk, A; Kaczynski, M; Cieslik-Bielecka, A; Bialecki, J; Domoslawski, P.

ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2024110020

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 4 November 2024 and was last updated on 4 November 2024.

INTRODUCTION

Review question / Objective The aim of this study was to perform a systematic literature review and meta-analysis in order to determine factors influencing parathyroid gland (PTG) autofluorescence (AF) intensity.

Condition being studied Thyroidectomy is a procedure of partial or total resection of the thyroid gland. The most crucial step in performing thyroidectomies is to localize parathyroid glands in order to reduce most common complications such as postoperative hypocalcemia. It has been proven that near-infrared devices based on autofluorescence of parathyroid gland reduces unintentional resection or damage of PTGs. Although many factors are suggested to influence autofluorescence intensity, it is unclear whether these factors increase or decrease AF intensity.

METHODS

Search strategy A systematic literature search of PubMed, Embase and Cochrane databases. The main inclusion criteria comprised studies on patients undergoing thyroidectomy with application of near-infrared AF (NIRAF) devices and availability of calcium and parathormone levels as well as AF intensity values.

Participant or population Patients who underwent their first partial or total thyroidectomy procedure for benign or malignant pathology, implemented NIRAF without any dye colorant (indocyanine green, methylene blue, etc.).

Intervention The evaluation of parathyroid glands autofluorescence rate by implementation of NIRAF devices during thyroidectomies.

Comparator Not applicable.

Study designs to be included Non-randomized prospective studies.

Eligibility criteria (1) Additional inclusion criteria: Full-text English-language clinical studies that reported patients who underwent their first partial or total thyroidectomy procedure for benign or malignant pathology, implemented NIRAF without any dye colorant (indocyanine green, methylene blue, etc.). (2) Additional exclusion criteria: Systematic reviews, meta-analyses, letters to the editor, technical notes, case-reports, editorials and conference papers, studies on pediatric popultion, papers that included reoperated patients, papers where PTG fluorescence intenisty was evaluated ex-vivo.

Information sources A Cochrane, Embase and PubMed databases were searched by two authors independently, for studies published from inception to 19th September 2023. Any discrepancies between the researches were discussed unitl a consensus was reached.

Main outcome(s) To determine factors influencing PTGs AF intenisty with implementation of NIRAF devices.

Quality assessment / Risk of bias analysis The quality of each study included into the meta-analysis was evaluated by two authors independently using QUADAS II (Quality Assessment of Studies of Diagnostic Accuracy Included in the Systematic Reviews II) tool.

Strategy of data synthesis A meta-analysis of papers concerning the use of NIRAF in identifying PTGs during thyroid surgery was performed. Models with variable effects were used in this study, taking into account the variability of effects between studies. The I2 statistic was used for heterogeneity assessment. The results of the heterogeneity analysis were interpreted in the context of decisions regarding the effect model and the elimination of papers that were a potential source of heterogeneity. Meta-regression analysis was used to evaluate how different variables influenced differences in effects between studies. All statistical analyses were performed using PqStat 1.8.6 software (PQStat Software, Poznan, Poland). A level of significance was established at $p < 0.05$.

Subgroup analysis The following data were extracted from each included study: (1) basic study characteristics such as the first author, year of publication, and study design, (2) number of patients, body mass index (BMI), age and sex; (3)

method of parathyroid identification, (4) serum calcium and parathormone concentration levels, and (5) parathyroid-to-background score, measured as a ratio of parathyroid fluorescence to background intensity. This score was calculated objectively, with usage of ImageJ software.

Sensitivity analysis A meta-analysis of papers concerning the use of NIRAF in identifying PTGs during thyroid surgery was performed. Models with variable effects were used in this study, taking into account the variability of effects between studies. The I2 statistic was used for heterogeneity assessment. The results of the heterogeneity analysis were interpreted in the context of decisions regarding the effect model and the elimination of papers that were a potential source of heterogeneity. Meta-regression analysis was used to evaluate how different variables influenced differences in effects between studies. All statistical analyses were performed using PqStat 1.8.6 software (PQStat Software, Poznan, Poland). A level of significance was established at $p < 0.05$.

Language restriction English.

Country(ies) involved Poland.

Keywords Parathyroid gland; near-infrared autofluorescence; fluorescence intensity.

Contributions of each author
Author 1 - Marcin Adamiecki - Author 1 was responsible for conceptualization, methodology, validation, formal analysis, investigation, data curation, writing original draft, review and editing.
Email: marcinadam998@gmail.com
Author 2 - Lukasz Antkowiak - Author 2 was responsible for conceptualization, methodology, validation, formal analysis, investigation, writing original draft, review and editing.
Email: lukaszantkowiak7@gmail.com
Author 3 - Ryszard Antkowiak - The author wrote, edited and supervised the manuscript.
Email: ryszardantkowiak@wp.pl
Author 4 - Anna Kasperczuk - The author performed statistical analysis of the presented data.
Email: a.kasperczuk@pb.edu.pl
Author 5 - Maciej Kaczynski - The author was responsible for statistial analysis of the provided data and manuscript translation.
Email: mackaczynski@wp.pl
Author 6 - Agata Cieslik-Bielecka - The author supervised and reviewed the manuscript.
Email: agatabielecka@poczta.onet.pl

Author 7 - Jacek Bialecki - The author provided necessery data and was responsible for the manuscript translation.
Email: jacekt.bialecki@gmail.com
Author 8 - Pawel Domoslawski - The author supervised and reviewed the manuscript.
Email: pawel.domoslawski@umed.wroc.pl