DANISH MEDICAL JOURNAL

Original Article

Peritonsillar abscess assessment tool

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Dan Med J 2024;71(8):A01240060. doi: 10.61409/A01240060

ABSTRACT

INTRODUCTION. We developed and validated a patient-reported outcome measurement for measuring the severity of symptoms and efficacy of different treatment modalities in patients with peritonsillar abscess (PTA).

METHODS. A 19-item questionnaire was constructed using a five-point Likert scale. Fifteen to 40-year-old patients with PTA treated at two ear-nose-throat departments completed the survey. Healthy students served as controls.

RESULTS. A total of 51 PTA patients and 76 controls were included. Twelve items had appropriate inter-item correlations (in the 0.25-0.75 range) and high mean scores (> 3.5) among patients and were therefore included in the final tool, coined the peritonsillar abscess assessment tool (PAAT)-12. The patients' mean PAAT-12 score was 49.0 (95% confidence interval (CI): 46.8-51.1) at the time of inclusion compared with 14.2 (95% CI: 13.7-14.7) for controls ($p < 0.001$). The Cronbach's alpha coefficient for the questionnaire was 0.86. The standard error of measurement was 4.98, the intraclass correlation 0.88 and the Spearman correlation test-retest reliability 0.79.

CONCLUSION. The reliability and validity of the PAAT-12 were very high. The PAAT-12 is the first validated tool for measuring the severity and duration of symptoms from the perspective of PTA patients and for quantifying and comparing different treatment modalities in PTA patients.

FUNDING. Overlærer Svend Hansens Fond.

TRIAL REGISTRATION. The study was approved by the Danish Data Protection Agency (-16-02-356-19).

Peritonsillar abscess (PTA) refers to a collection of pus between the tonsillar capsule and the lateral constrictor muscle. PTA is a complication of acute tonsillitis and the most frequent abscess in the head and neck (41 cases/100,000 population) [1]. The highest PTA incidence rates are found in the 15-40-year age groups [2]. PTA patients commonly experience considerable discomfort and dehydration as a consequence of severe throat pain, especially on swallowing, leading to a reduced intake of fluids and foods [1, 3].

The primary management of PTA is surgical drainage. Three accepted surgical methods of draining PTAs exist: needle aspiration, incision and drainage (ID) and acute tonsillectomy. In previous studies, needle aspiration and ID were found to have high success rates (up to 90%) without significant differences between the two procedures [4]. Other advantages of needle aspiration and ID over tonsillectomy include possible outpatient management and avoidance of general anaesthesia. However, antibiotic therapy is uniformly recommended in tonsil-sparing treatment to reduce the risk of abscess recurrence and the spread of infection [5, 6]. Multiple antibiotic regimes have been recommended in the literature [7-11]. Benzyl-/phenoxymethyl-penicillin are the drugs of choice at our institution (for in- and outpatient management, respectively). Acute tonsillectomy is the preferred treatment method in children and adults who cannot cooperate with treatment in local anaesthesia or who suffer from

chronic or recurrent tonsillitis. Acute tonsillectomy secures complete abscess drainage, and the treatment requires no antibiotic treatment [12]. The main concern associated with tonsillectomy is post-operative bleeding (observed in 6-7% of cases) [13, 14].

The current literature fails to determine which method of abscess drainage, which antibiotic regimen and which analgesic regimen are the most effective in reducing the intensity and duration of symptoms in PTA patients.

In pursuing quality data and reliable recommendations in treating patients with PTA, a need exists for a validated and preferably commonly used tool for assessing PTA symptoms in studies of various surgical, antibiotic and analgetic treatments. The common use of such a tool would facilitate inter-study comparisons and meta-analyses.

The present study was conducted to 1) establish a patient-reported outcome measurement, coined the peritonsillar abscess assessment tool (PTAAT), for assessing the severity of symptoms and the effects of various treatment modalities in patients with PTA and 2) assess the validity and reliability of the PTAAT.

Methods

Item generation

Initially, five patients with PTA described their symptoms prior to treatment. The list of patient-reported symptoms they produced was used to construct the items of the PTAAT. Additional items were included based on recommendations from five otolaryngologists. Redundant items were removed, and the authors subsequently selected a list of 19 items. Finally, five other PTA patients evaluated the phrasing of the PTAAT-19 items. All items were subsequently arranged on a five-point Likert scale.

Patients and controls

This prospective questionnaire study was conducted between August 2020 and April 2023 at two departments of otorhinolaryngology, head & neck Surgery (at Aarhus University Hospital and Aalborg University Hospital, Denmark).

Patients referred due to suspected PTA were invited to participate in the study. The participant answered the online questionnaire twice: at the time of arrival and 30 minutes later (emails with a link to the questionnaire were delivered to them automatically). The questionnaire was conducted in Danish language.

The study included Danish-speaking patients aged 15-40 years diagnosed with PTA (based on visual detection of peritonsillar pus) and without dissemination of infection (e.g., para- or retropharyngeal abscess, Lemierre´s syndrome). Medical students aged 15-40 years without recent-onset (within the past month) throat symptoms served as controls. The exclusion criteria for both groups were: 1) chronic pain or daily use of analgesics, 2) medical history of swallowing, gastro-oesophageal reflux, neoplastic, haematologic, rheumatologic, neurologic or upper airway disorders and 3) previous tonsillectomy.

The following data were obtained on all patients: age, gender, smoking, duration of symptoms, antibiotic treatment prior to admission, previous tonsillectomy, biochemistry (infection markers and *mononucleosis tests), pus volume, surgical and medical management, hospitalisation and microbiological findings.*

Item reduction and reliability analysis

Inter-item correlations were estimated for the 19 items using Spearman correlation to evaluate item redundancy. Test-retest reliability was evaluated by administering the survey on two separate occasions to the patients with PTA (30-minute interval separation administrations) and healthy controls (seven-day interval separating

administrations). The short time interval between survey administrations to PTA patients was chosen in response to the tradeoff between the potential for improvement of symptoms after abscess drainage and the risk of recall bias. The test-retest reliability was evaluated by Spearman correlation between the two scores. The internal consistency was assessed using Cronbach´s alpha. Generally, the lowest acceptable level of internal consistency is 0.7 for group-level and 0.9 for individual-level analysis.

Validity and responsiveness analysis

The validity of the tool was examined by unmatched case-control contrast between PTA patients and healthy controls. The responsiveness of the tool was assessed by examining the scores before (day 1) and after (day 2-8 + 14) surgical treatment of patients with PTA; all patients were surgically treated).

Statistical analyses

Missing data were imputed from the mean of completed items, provided that >50% of the items had been completed. Statistical analyses were performed using Student's t-test, Fisher's exact test, the Kruskal-Wallis test and analysis of variance (ANOVA). Statistical significance was defined as $p<0.05$.

Permissions

All participants (and parents of minors) gave their informed consent before their inclusion in the study. According to Danish law, notification of the study to the local ethical committee was not required.

Trial registration: The study was approved by the Danish Data Protection Agency (-16-02-356-19).

Results

Patient and healthy control characteristics

A total of 51 patients with PTA and 76 healthy controls answered the questionnaire. 55% (28/51) of the patients and 67% (51/76) of the controls were females ($p = 0.19$, Fisher's exact test). No significant difference was found between the ages of patients (mean 24.7 years) and controls (mean 25.9 years; $p = 0.17$, Student's t-test). Patient characteristics are presented in **Table 1**.

TABLE 1 Characteristics of 51 patients with peritonsillar abscess.

Females, n (%)	28 (55)
Age, mean (± SD), yrs	24.7 (± 6.6)
Current smoking, n (%)	6 (12)
Duration of symptoms, mean (± SD), days	5.5 (± 2.8)
Antibiotics prior to admission, n (%)	23 (45)
Acute tonsillitis episodes, median (range), n	
Past 12 mos.	1 (0-10)
Past 24 mos.	1 (0-16)
Chronic tonsillitis, n (%)	1 (2)
Previous PTA, n (%)	7 (14)
Biochemistry, mean (± SD)	
CRP, mg/l	129 (± 77)
Cell count, × 10^9/l:	
Leukocytes	15.3 (± 4.3)
Neutrophils	11.6 (± 4.3)
Lymphocytes	2.3 (± 1.9)

PTA = peritonsillar abscess; SD = standard deviation.

Removal of redundant items

Items (difficulty breathing), (decreased appetite), (difficulty swallowing my saliva) and (cough) had low correlations (< 0.25) with most other items and were therefore removed from the survey instrument (**Table 2**). Items (difficulty swallowing) and (difficulty attending my work/school) had very high (> 0.75) correlations with items (pain on swallowing) and (reduced my level of activity), respectively. They were therefore removed from the instrument. Acceptable correlations (0.25-0.75) were found for the other items. Additionally, item (feel feverish) was removed from the survey due to a low mean score: 2.51 (< 3.5).

TABLE 2 Inter-item correlations (Spearman) between the 19 items in peritonsillar abscess assessment tool-19. Low (< 0.25) correlations are shown in red.

Item		Item #																		
#	description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Fever	1.0																		
2	Uncomfortable	0.54	1.0																	
3	Ill	0.45	0.73	1.0																
4	Difficulty breathing	0.18	0.09	0.13	1.0															
5	Throat pain	0.32	0.46	0.39	−0.02	1.0														
6	Pain on swallowing	0.40	0.54	0.40	0.28	0.66	1.0													
7	Difficulty swallowing	0.43	0.51	0.31	0.33	0.60	0.93	1.0												
8	Globulus	0.35	0.45	0.42	0.30	0.26	0.48	0.54	1.0											
9	Decreased appetite	0.34	0.21	0.15	−0.10	0.47	0.38	0.40	0.19	1.0										
10	Trismus	0.18	0.32	0.17	0.07	0.44	0.59	0.65	0.54	0.40	1.0									
11	Ear pain	0.45	0.45	0.31	0.20	0.35	0.48	0.50	0.41	0.30	0.44	1.0								
12	Muffled voice	0.36	0.47	0.38	0.12	0.34	0.46	0.51	0.49	0.21	0.47	0.51	1.0							
13	Difficulty swallowing my saliva	−0.02	−0.16	−0.03	0.03	−0.37	−0.37	−0.46	−0.33	−0.17	−0.34	−0.07	−0.19	1.0						
14	Bad breath	0.36	0.15	0.13	0.19	0.34	0.23	0.31	0.38	0.26	0.23	0.26	0.21	−0.15	1.0					
15	Cough	0.35	0.14	0.08	0.24	0.19	0.25	0.28	0.28	0.18	−0.04	0.18	0.34	−0.14	0.06	1.0				
16	Swollen on my neck	0.26	0.37	0.31	0.20	0.26	0.27	0.35	0.47	0.00	0.36	0.23	0.38	−0.16	0.34	0.13	1.0			
17	Difficulty sleeping	0.30	0.47	0.28	0.23	0.37	0.56	0.47	0.26	−0.01	0.09	0.34	0.37	−0.21	0.10	0.37	0.13	1.0		
18	Difficulty attending work/school	0.36	0.46	0.49	0.16	0.32	0.54	0.46	0.28	0.15	0.26	0.21	0.19	−0.11	0.21	0.04	0.16	0.53	1.0	
19	Reduced level of activity	0.37	0.50	0.48	0.06	0.19	0.40	0.32	0.26	0.22	0.21	0.22	0.20	0.01	0.31	−0.17	0.21	0.30	0.76	1.0

The mean scores for all items were very low in the control group (**Table 3**). Table 3 shows the PTAAT-19 (all items) and the PTAAT-12 (final survey). Among the 12 items of the PTAAT-12, eight items were categorised as throat specific and four as general items.

TABLE 3 The peritonsillar abscess (PTA) assessment tool (PTAAT)-19 (all items) and the PTAAT-12 (final questionnaire).

		At present, to what degree[a] do you experience the following symptoms and are the following daily activities restricted?		
			mean score[b]	
Item #		symptom	patients with PTA (N = 51)	controls (N = 76)
PTAAT-19 and PTAAT-12[c]				
2	General	I feel uncomfortable	3.86	1.17
3	General	I feel ill	3.86	1.19
5	Specific	I have throat pain	4.55	1.22
6	Specific	I have pain on swallowing	4.73	1.08
8	Specific	I feel a lump in my throat	4.41	1.26
10	Specific	I have difficulty opening my mouth	4.08	1.05
11	Specific	I have ear pain	3.63	1.22
12	Specific	My voice is muffled	4.02	1.12
14	Specific	I have a bad breath	3.59	1.43
16	Specific	I feel swollen on my neck	4.22	1.13
17	General	I have difficulty sleeping	3.90	1.60
19	General	I have reduced my level of activity	4.10	1.29
Only PTAAT-19				
1	General	I feel feverish	2.54	1.06
4	Specific	I have difficulty breathing	2.20	1.09
7	Specific	I have difficulty swallowing	4.59	1.07
9	General	I have a decreased appetite	3.98	1.13
13	Specific	I have difficulty swallowing my saliva	3.63	2.26
15	Specific	I have a cough	1.65	1.47
18	General	I have difficulty attending my work/school	3.94	1.23

a) 1: not at all; 2) to a low degree; 3) to a moderate degree; 4) to a high degree; 5) to a very high degree.
b) At the time of inclusion.
c) Criteria for inclusion in PTAAT-12: inter-item correlation in the 0.25-0.75 range and mean score > 3.5.

Reliability

Patients´ mean PTAAT-12 scores were 49.0 (95% confidence interval (CI): 46.8-51.1) at the time of inclusion and 47.0 (95% CI: 44.6-49.5) 30 minutes later (p = 0.008, Student's t-test).

Cronbach´s alpha coefficient was 0.86 for the first and 0.89 for the second measurement. Both results exceed the minimum acceptable value for group-level analysis, suggesting that each item addresses the same construct. The standard error of measurement was 4.98 (95% CI: 4.17-6.19), and the intraclass correlation was 0.88 (95% CI: 0.78-0.94). Finally, the Spearman correlation test-retest was 0.79.

Normative data generation

The healthy controls' mean PTAAT-12 scores were 14.2 (95% CI: 13.7-14.7) at the time of inclusion and 13.6 (95% CI: 13.0-14.2) 8 days later (p = 0.12, Student's t-test). The Cronbach´s alpha coefficient was 0.63 for the first and 0.53 for the second measurement. The standard error of measurement was 1.84 (95% CI: 1.53-2.29).

Validity

The differences in mean scores in the individual items of the PTAAT-12 between patients and controls (at the time of inclusion) fell within the 2.16-3.65 range (p < 0.001 for all individual items, Student's t-test). No statistically significant associations were found between PTAAT scores and gender (p = 0.35, Student´s t-test), previous PTA (p = 0.68), duration of symptoms (p = 0.42, ANOVA), inflammatory parameters (p > 0.20 for all), and age (p = 0.41).

Responsiveness analysis

A total of 36 (71%) and 37 (73%) patients completed the questionnaire 8 and 14 days after inclusion, respectively. The PTAAT-12 scores were 23.6 (95% CI: 19.8-27.5) and 18.5 (95% CI: 15.9-21.2) at 8- and 14-day follow-up, both significantly lower than at the time of inclusion (both p < 0.001, Student´s t-test). The PTAAT-12 score at the 14-day follow-up was significantly lower than at the 8-day follow-up (p = 0.002).

Discussion

The reliability of the final PTAAT-12 questionnaire was found to be excellent based on the calculated Cronbach's alpha coefficient, intraclass correlation, Spearman correlation test-retest reliability and standard error of measurement. Though the mean PTAAT-12 scores decreased significantly (by 2.0 points) from the time of inclusion to the second answer 30 minutes later, both the initial and second scores were much higher in patients than controls (mean differences: 34.8 and 33.4, respectively). Hence, the reliability of the survey remains intact. The validity of PTAAT-12 was also found to be good based on the highly significant differences in the individual items and summarised scores between patients and controls (all p < 0.001).

The Cronbach's alpha coefficient and the intraclass correlation were low for the control group, which was expected as the survey items were designed to reflect symptoms in patients with PTA and not in healthy individuals.

The items of the PTAAT-12 were categorised into two domains: throat-specific symptoms (items 5, 6, 8, 10, 11, 12, 14, and 16) and general symptoms (items 2, 3, 17, and 19). The mean scores of throat-specific symptoms (4.15 points) were slightly but significantly higher than those of general symptoms (3.94 points) (p = 0.016, Student´s t-test). The combined facts that scores were high in all items and that inter-item correlations were appropriately high stress that more items are needed to characterise patients´ illness and evaluate treatment efficacy.

The PTAAT-12 was developed for use in future studies on the effects of different treatments (e.g., surgery, antibiotics) of PTA. The survey may be used to construct diagrams with PTAAT-12 scores on the y-axis and time on the x-axis to illustrate and calculate differences in the efficacy of different treatment methods in alleviating patients´ symptoms. Furthermore, developing a validated tool will allow for inter-study comparisons and reliable meta-analyses when commonly used.

We noted that PTAAT scores were stable between males and females and did not correlate with patients´ age, the duration of symptoms, biochemical inflammatory parameters or previous PTA.

The study has several limitations. The study was conducted in Denmark, and the questionnaires that the patients answered were prepared in Danish. Hence, the survey wording in Table 3 is an English translation, and English-speaking patients could interpret and answer questions slightly differently. Adolescents and adults 15-40 years

old were included in the study because the incidence of PTA peaks in this age group. Children were disregarded to avoid potentially conflicting symptoms as symptoms in children may be different than symptoms presented in adults, and to eliminate the risk of children misunderstanding the questions. The number of participants was relatively limited, but the level of statistical significance between patients and controls was very high ($p < 0.001$) for all items, and adding more patients is unlikely to alter our results and conclusions.

Conclusion

This is the first study to develop and validate a questionnaire for future treatment studies of patients with PTA. The PTAAT-12 is a reliable and sensitive tool for measuring the intensity of symptoms over time from the patients' perspective and evaluating and comparing different treatment modalities.

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Accepted 3 May 2024

Conflicts of interest Potential conflicts of interest have been declared. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

References can be found with the article at ugeskriftet.dk/dmj

Cite this as Dan Med J 2024;71(8):A01240060

doi 10.61409/A01240060

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