



Treatment Outcomes And Patient Satisfaction Following The Karydakias Procedure For Pilonidal Sinus Disease: A Retrospective Cohort Study With Near-Equal Female Representation

Dr. Anu V. Babu^{1†}, Dr. Ashwin Shaji^{2†*}, Dr. Sreelekshmi S³

^{1,2,3}Department of General Surgery, Sree Gokulam Medical College and Research Foundation, Thiruvananthapuram, Kerala, India

***Corresponding Author:**

Dr. Ashwin Shaji

Department of General Surgery, Sree Gokulam Medical College and Research Foundation, Thiruvananthapuram, Kerala, India

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background: Pilonidal sinus disease (PSD) is a chronic inflammatory condition affecting the sacrococcygeal region and predominantly involves young adults. Although traditionally considered a male-predominant disease, changing lifestyle patterns may be contributing to greater female representation. Off-midline procedures such as the Karydakias flap have demonstrated favorable healing and patient-reported outcomes.

Materials and Methods: A retrospective cohort study was conducted at the Department of General Surgery, Sree Gokulam Medical College and Research Foundation, Kerala. Records of patients who underwent the Karydakias procedure between January 2019 and December 2023 were reviewed. Demographic and lifestyle characteristics, clinical presentation, postoperative complications, wound healing, follow-up symptoms, quality-of-life improvement and patient satisfaction were analyzed. Telephonic follow-up was used for patient-reported outcomes. Statistical analysis was performed using IBM SPSS Statistics version 26.0.

Results: Eighty-five patients were included. Mean age was 26.13 ± 8.17 years; 43.5% were aged 18–24 years and 37.6% were aged 25–34 years. Males constituted 51.8% and females 48.2%. Mean BMI was 26.33 ± 3.85 kg/m², with 71.8% having BMI ≥ 25 kg/m². Sedentary work was reported by 77.6% and 75.4% sat for at least 5 hours/day. Mean postoperative pain score was 2.51 ± 1.34 and mean quality-of-life improvement score was 7.65 ± 1.30 . Complications occurred in 10.6%. Mean wound healing time was 3.63 ± 0.98 weeks without complications versus 4.56 ± 0.73 weeks with complications ($p=0.006$). At six months, 77.6% were satisfied or very satisfied and 76.5% would recommend the procedure.

Conclusion: The Karydakias procedure provided favorable postoperative and patient-reported outcomes. The near-equal representation of females in this cohort is notable and warrants further investigation in larger epidemiological studies.

Keywords: Karydakias procedure; Patient satisfaction; Pilonidal sinus disease; Quality of life; Retrospective cohort; Sociodemographic profile

Introduction

Pilonidal sinus disease (PSD) is a chronic inflammatory disorder of the sacrococcygeal region characterized by sinus tracts containing hair, debris and granulation tissue. It predominantly affects adolescents and young adults and has traditionally

been described as a male-predominant condition [1-3]. The currently accepted acquired theory proposes that loose hair penetrates the natal cleft skin and produces a foreign-body inflammatory response, with friction,

pressure, moisture and local anatomy contributing to sinus formation [2,3].

Several factors have been associated with PSD, including obesity, excessive hair, deep natal cleft anatomy, sedentary occupation and prolonged sitting [3-5]. The condition can cause pain, swelling, discharge and recurrent infection, with consequent effects on daily activities and quality of life [1,6].

Surgical management has evolved from excision with secondary healing and midline closure toward off-midline procedures. Meta-analytic evidence supports the advantages of off-midline closure over conventional midline closure with respect to wound complications and recurrence [7-9].

The Karydakakis procedure, described by Karydakakis in 1992, uses an asymmetric excision with lateralization of the closure and flattening of the natal cleft [10]. This approach aims to remove diseased tissue while reducing midline tension, moisture retention and hair accumulation. Comparative studies and meta-analyses have demonstrated favorable functional and patient-reported outcomes with the Karydakakis technique [11-14].

Although PSD has historically shown male predominance, contemporary clinical series have reported mixed-gender cohorts and a narrowing gender gap [15]. The present study evaluated the clinico-sociodemographic profile, treatment outcomes and patient satisfaction following the Karydakakis procedure, with particular attention to the near-equal representation of females observed in the study population.

Materials And Methods

Study design and setting: This retrospective cohort study was conducted in the Department of General Surgery, Sree Gokulam Medical College and Research Foundation, Thiruvananthapuram, Kerala, India. The retrospective review covered patients who underwent the Karydakakis procedure between January 2019 and December 2023.

Study population: All eligible patients diagnosed clinically with sacrococcygeal PSD who underwent Karydakakis flap surgery during the study period were considered. Complete enumeration of eligible cases was used, yielding a sample of 85 patients.

Inclusion criteria: Patients of any age or sex with clinically diagnosed sacrococcygeal PSD who underwent the Karydakakis procedure and had retrievable operative and postoperative records were included. Patients available for telephonic follow-up or data verification were included for patient-reported outcomes.

Exclusion criteria: Patients with incomplete records, those undergoing other surgical procedures for PSD, patients with previous surgical recurrence, and those unable to participate in follow-up because of communication or cognitive barriers were excluded.

Data collection: Data were extracted from medical records using a structured proforma. Variables included age, sex, BMI, educational status, occupation, work activity, sitting duration, duration of symptoms, presenting symptoms, postoperative pain, wound complications, wound healing time, follow-up symptoms, satisfaction, cosmetic outcome, willingness to recommend the procedure and perceived quality-of-life improvement. Telephonic follow-up was conducted at a minimum of six months for patient-reported outcomes.

Statistical analysis: IBM SPSS Statistics version 26.0 was used. Continuous variables were summarized as mean $\pm$ standard deviation or median with interquartile range as appropriate. Categorical variables were expressed as frequencies and percentages. Chi-square testing was used for categorical associations, while Fisher's exact test was used where appropriate. The Mann-Whitney U test was used for comparison of wound-healing distributions. A p value <0.05 was considered statistically significant.

Ethical considerations: Institutional Ethics Committee approval was obtained. The study adhered to the ethical principles of the Declaration of Helsinki. Written informed consent was obtained for participation, and verbal consent was obtained for telephonic follow-up. Patient identifiers were removed and confidentiality was maintained.

Results

Eighty-five patients underwent the Karydakakis procedure during the study period. The cohort was predominantly young, with 81.1% aged 18–34 years. The mean age was 26.13 ± 8.17 years (median 24 years; range 14–57 years).

Gender distribution was nearly equal: 44 patients (51.8%) were male and 41 (48.2%) were female. The association between age group and gender was not statistically significant ($\chi^2=5.641$, $df=4$, $p=0.228$).

The mean BMI was 26.33 ± 3.85 kg/m². Twenty-four patients (27.1%) had normal BMI, 36 (42.4%) were overweight and 25 (29.4%) were obese; therefore, 71.8% had BMI ≥ 25 kg/m². Students and office/IT/desk-based workers constituted the largest occupational groups. Overall, 77.6% had sedentary work and 75.4% reported sitting for at least five hours per day.

Symptoms commonly preceded surgery for several months. Pain was the most frequent presenting feature (94.1%), followed by discharge (78.8%), swelling (43.5%) and itching (24.7%).

Mean postoperative pain score was 2.51 ± 1.34 , while mean quality-of-life improvement score was 7.65 ± 1.30 . Nine patients (10.6%) developed postoperative complications. Complications were most frequent among overweight patients (19.4%), although the association between BMI category and complications was not statistically significant ($p=0.075$).

Wound healing was significantly delayed in patients who developed complications. Mean healing time was 4.56 ± 0.73 weeks in patients with complications compared with 3.63 ± 0.98 weeks in those without complications (Mann–Whitney $U=158.0$, $Z=-2.760$, $p=0.006$).

At follow-up, 71 patients (83.5%) were symptom-free and 14 (16.5%) reported ongoing symptoms. Among symptomatic patients, pain and discharge were the most frequently reported complaints. No confirmed recurrence requiring reoperation or objective diagnostic confirmation was documented; therefore, persistent symptoms were not classified as recurrence.

At six months, 36 patients (42.4%) were very satisfied and 30 (35.3%) were satisfied, giving 77.6% positive satisfaction. Sixty-five patients (76.5%) reported that they would recommend the procedure. High satisfaction was significantly associated with absence of postoperative complications (81.6% without complications versus 44.4% with complications; $p=0.024$).

Discussion

The present study evaluated 85 patients undergoing the Karydakakis procedure and incorporated both conventional surgical outcomes and patient-reported measures. The mean age of 26.13 years and concentration of patients in the 18–34-year range are consistent with the established epidemiology of PSD, which predominantly affects adolescents and young adults [1-3].

The most notable observation was the near-equal gender distribution, with females comprising 48.2% of the cohort. Earlier literature has consistently described a male predominance, with some series reporting male-to-female ratios around 2:1 or greater [3,16]. Our study cannot establish an increase in incidence among females because it was not a population-based or time-trend study. Nevertheless, the near parity observed in this surgical cohort is noteworthy and supports further investigation of contemporary gender patterns in PSD.

A high prevalence of overweight and obesity was observed, with 71.8% of patients having BMI ≥ 25 kg/m². Obesity has been associated with PSD and postoperative morbidity, possibly through increased natal cleft depth, friction and local moisture [4,17]. In the present cohort, complications were numerically more frequent in the overweight group, although the association did not reach statistical significance ($p=0.075$). This finding should therefore be interpreted as a trend rather than evidence of an independent BMI effect.

Sedentary work was reported by 77.6% of participants, and 75.4% reported sitting for at least five hours per day. Students and desk-based workers formed the largest occupational groups. These findings support the established association between prolonged sitting, local pressure and mechanical factors in PSD [3,5]. However, because sitting duration was self-reported and there was no control group, the present study cannot establish causation.

The Karydakakis procedure produced favorable postoperative outcomes. Mean postoperative pain was low at 2.51 ± 1.34 , while the mean quality-of-life improvement score was 7.65 ± 1.30 . The complication rate of 10.6% was comparable to published Karydakakis cohorts [11-14]. In a randomized comparison, Ateş et al. reported lower postoperative pain and complication rates with Karydakakis compared with Limberg flap repair [11]. Meta-analytic evidence has demonstrated generally comparable overall complication profiles

between Karydakakis and Limberg procedures while identifying advantages in functional recovery and patient satisfaction with Karydakakis [13,14].

Wound healing was significantly prolonged among patients with postoperative complications, with mean healing times of 4.56 weeks versus 3.63 weeks in uncomplicated patients ($p=0.006$). This finding emphasizes that although the Karydakakis technique generally permits timely healing, wound morbidity remains an important determinant of recovery. Published Karydakakis series have similarly demonstrated acceptable healing times and low rates of major morbidity [12,18].

At six months, 77.6% of patients were satisfied or very satisfied and 76.5% would recommend the procedure. The association between complications and lower satisfaction was statistically significant, with high satisfaction in 81.6% of uncomplicated patients compared with 44.4% of those with complications ($p=0.024$). This reinforces the importance of patient-centered outcomes in evaluating PSD surgery. Comparative studies have also reported favorable cosmetic and satisfaction outcomes following Karydakakis repair [11,13,14].

Although 83.5% of patients were symptom-free at follow-up, 16.5% reported persistent symptoms. Importantly, no confirmed recurrence was documented. Because the study did not require reoperation or objective diagnostic confirmation to define recurrence, persistent pain or discharge should not be equated with recurrent disease. Longer follow-up is necessary because published studies demonstrate that recurrence can emerge after several years [18,19].

The principal strengths of this study are the complete enumeration of eligible cases, inclusion of sociodemographic and lifestyle characteristics, and incorporation of patient-reported outcomes. Limitations include the retrospective single-center design, absence of a control group, limited long-term follow-up, and use of non-validated numerical scales for satisfaction and quality-of-life improvement. Self-reported sitting duration and symptoms may also introduce recall bias. The study therefore provides a descriptive real-world assessment rather than comparative evidence of superiority.

Conclusion

The Karydakakis procedure demonstrated favorable postoperative and patient-reported outcomes in this cohort, with low postoperative pain, an acceptable complication rate, timely wound healing in most patients, substantial quality-of-life improvement and high patient satisfaction. Postoperative complications were significantly associated with delayed wound healing and lower satisfaction.

The near-equal male-to-female distribution, with females representing 48.2% of the cohort, is an important contemporary observation. Although this study cannot demonstrate a rising incidence of PSD among females, the finding supports further multicenter prospective research into gender-specific epidemiology and lifestyle-related risk factors.

Author Contributions

Dr. Anu V. Babu and Dr. Ashwin Shaji contributed equally to the conception and design of the study, data acquisition and analysis, interpretation of results, and preparation and critical revision of the manuscript. Dr. Sreelekshmi S contributed to the clinical management, data verification, and critical review of the manuscript. All authors approved the final manuscript and agree to be accountable for all aspects of the work.

Acknowledgements

The authors acknowledge the Department of General Surgery, Sree Gokulam Medical College and Research Foundation, and all patients who participated in the study.

Ethical Approval

Institutional Ethics Committee approval was obtained. The study adhered to the ethical principles of the Declaration of Helsinki. Informed consent was obtained from participants, including consent for telephonic follow-up.

References

1. Sondenaa K, Andersen E, Nesvik I, Søreide JA. Patient characteristics and symptoms in chronic pilonidal sinus disease. *Int J Colorectal Dis.* 1995;10(1):39-42.
2. Chintapatla S, Safarani N, Kumar S, Haboubi N. Sacrococcygeal pilonidal sinus: historical review, pathological insight and surgical options. *Tech Coloproctol.* 2003;7(1):3-8.
3. Akinci OF, Bozer M, Uzunköy A, Düzgün SA, Coşkun A. Incidence and aetiological factors in

- pilonidal sinus among Turkish soldiers. *Eur J Surg*. 1999;165(4):339-42.
4. Harlak A, Menten O, Kilic S, Coskun K, Duman K, Yilmaz F. Sacrococcygeal pilonidal disease: analysis of previously proposed risk factors. *Clinics (Sao Paulo)*. 2010;65(2):125-31.
 5. Keshvari A, Keramati MR, Fazeli MS, et al. Risk factors for pilonidal sinus disease and recurrence. *J Surg Res*. 2016;200(2):560-5.
 6. Sevinç B, Karahan Ö, Okuş A, Ay S, Aksoy N, Şimşek G. Randomized prospective comparison of midline and off-midline closure techniques in pilonidal sinus surgery. *Surgery*. 2016;159(3):749-54.
 7. Al-Khamis A, McCallum I, King PM, Bruce J. Healing by primary versus secondary intention after surgical treatment for pilonidal sinus. *Cochrane Database Syst Rev*. 2010;(1):CD006213.
 8. McCallum IJ, King PM, Bruce J. Healing by primary closure versus open healing after pilonidal sinus surgery. *BMJ*. 2008;336:868-71.
 9. Stauffer VK, Luedi MM, Kauf P, et al. Common surgical procedures in pilonidal sinus disease: a meta-analysis. *Sci Rep*. 2018;8:3058.
 10. Karydakos GE. Easy and successful treatment of pilonidal sinus after explanation of its causative process. *Aust N Z J Surg*. 1992;62(5):385-9.
 11. Ateş M, Dirican A, Sarı S, et al. Short and long-term results of the Karydakos flap versus the Limberg flap for pilonidal sinus disease: prospective randomized study. *Int J Surg*. 2011;9(5):476-9.
 12. Durr-I-Chaman M, Ali A, Alam SN, Qureshi F, Mirza M, Hussain M. Karydakos flap: a preferred procedure for sacrococcygeal pilonidal sinus disease. *Pak J Med Health Sci*. 2020;14(4):1273-7.
 13. Gavrilidis P, Bota E, Georgiou C. Limberg flap versus Karydakos flap for treatment of pilonidal sinus disease: meta-analysis of randomized controlled trials. *World J Surg*. 2019;43(7):1906-14.
 14. Emile SH, Elfeki H, Sakr A, Shalaby M, Christensen P, Wexner SD. Meta-analysis of randomized controlled trials comparing Karydakos and Limberg flaps for management of pilonidal sinus disease. *Surgery*. 2021;169(3):546-56.
 15. Breidung V, Ehrl D, Duscher D, Dragu A, Felmerer G, Horch RE, et al. Evaluation of clinical outcomes and quality of life following the Karydakos flap procedure for pilonidal sinus treatment. *J Plast Reconstr Aesthet Surg*. 2024;77(4):1123-31.
 16. Topgül K, Ozdemir E, Kilic K, Gökbayir H. Long-term results of surgical procedures for sacrococcygeal pilonidal sinus. *Dis Colon Rectum*. 2003;46(6):712-7.
 17. Cubukçu A, Gönüllü NN, Paksoy M, Alponat A, Kuru M, Ozbay O. The role of obesity on the recurrence of pilonidal sinus disease in patients treated by excision and Limberg flap transposition. *Int J Colorectal Dis*. 2000;15(3):173-5.
 18. Kumar S, Singh R, Singh N, Kumar R. Karydakos flap procedure for sacrococcygeal pilonidal sinus disease: a 10-year experience. *Indian J Plast Surg*. 2014;47(3):387-92.
 19. De Robles MS, Young CJ. The Karydakos procedure performed with the patient in a lateral position: a retrospective review of 97 cases. *Colorectal Dis*. 2019;21(2):190-5.
 20. Doll D, Kauf P, Petersen S, et al. Long-term outcome following Karydakos procedure. *Dis Colon Rectum*. 2015;58(10):1007-13.

Tables

Table 1 : Demographic and Anthropometric Characteristics of Study Participants (n = 85)

Variable	Frequency (n)	Percent (%)
15–17 years	7	8.2
18–24 years	37	43.5
25–34 years	32	37.6

35–44 years	4	4.7
≥45 years	5	5.9
Male	44	51.8
Female	41	48.2
Normal BMI (18.5–24.9 kg/m ²)	24	27.1
Overweight BMI (25.0–29.9 kg/m ²)	36	42.4
Obese BMI (≥30 kg/m ²)	25	29.4

Table 2 : Occupational, Sitting and Clinical Characteristics (n = 85)

Variable	Frequency (n)	Percent (%)
Sedentary work	66	77.6
Moderately active work	10	11.8
Very active work	9	10.6
≤4 h/day sitting	21	24.7
5–6 h/day sitting	44	51.8
7–8 h/day sitting	10	11.8
≥9 h/day sitting	10	11.8
Pain at presentation	80	94.1
Discharge from sinus	67	78.8
Swelling	37	43.5
Itching	21	24.7
Bleeding	6	7.1
Other symptoms	6	7.1

Note: Clinical symptoms were multiple-response variables; percentages therefore do not total 100%.

Table 3 : Postoperative Outcomes and Complications Following the Karydakakis Procedure

Outcome	Value
Mean postoperative pain score (0–10)	2.51 ± 1.34
Mean quality-of-life improvement score (0–10)	7.65 ± 1.30
Postoperative complications	9/85 (10.6%)

Mean wound healing time without complications	3.63 ± 0.98 weeks
Mean wound healing time with complications	4.56 ± 0.73 weeks
Symptom-free at follow-up	71/85 (83.5%)
Ongoing symptoms at follow-up	14/85 (16.5%)
Confirmed recurrence requiring reoperation/objective confirmation	None documented

Table 4 : Patient Satisfaction and Statistical Associations

Analysis	Result	p value
Satisfied/very satisfied at 6 months	66/85 (77.6%)	—
Would recommend the procedure	65/85 (76.5%)	—
BMI category vs postoperative complication	Fisher's exact test	0.075
Complication vs wound healing	3.63 ± 0.98 vs 4.56 ± 0.73 weeks; Mann–Whitney U=158.0	0.006
Complication vs high satisfaction	81.6% without complications vs 44.4% with complications; Fisher's exact test	0.024
Age group vs gender	Pearson $\chi^2=5.641$, df=4	0.228

Figures

Figure 1 : Gender distribution among patients undergoing the Karydakis procedure.

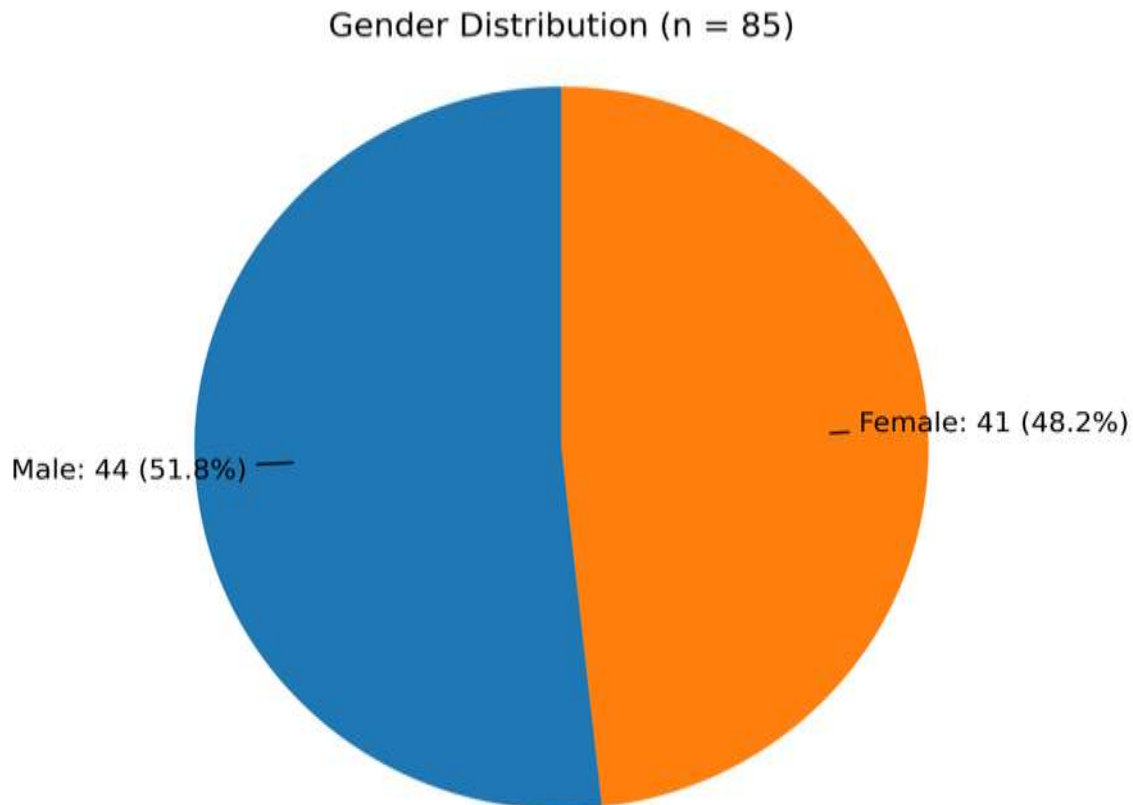


Figure 2 : Distribution of patients according to age group.

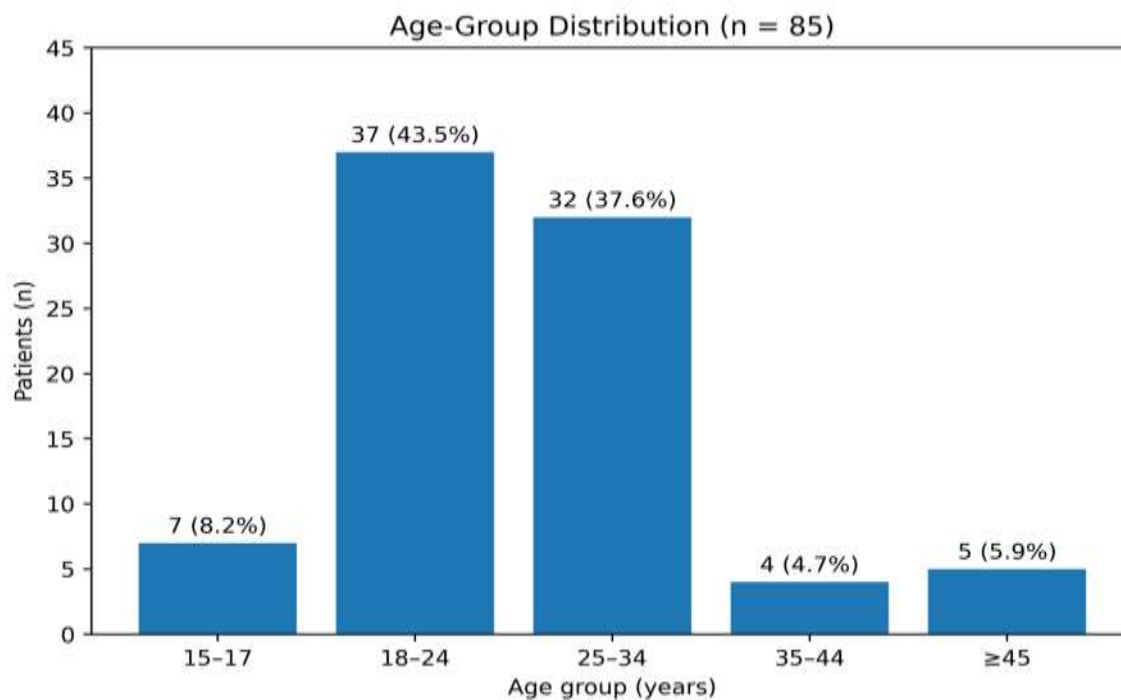


Figure 3 : Patient satisfaction at six months after the Karydakis procedure.

