Section: General Surgery

Original Research Article

COMPARATIVE STUDY OF 5% PHENOL IN ALMOND OIL VERSUS 3% SODIUM TETRADECYL SULPHATE AS SCLEROSING AGENTS IN GRADE I AND II HEMORRHOIDS: A PROSPECTIVE INTERVENTIONAL STUDY

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Received : 12/04/2025
Received in revised form : 03/06/2025
Accepted : 20/06/2025

Keywords:
Hemorrhoids, Sclerotherapy, Phenol, Sodium tetradecyl sulphate, Proctology.

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DOI: 10.47009/jamp.2025.7.4.288

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (4); 1520-1525

ABSTRACT

Background: Injection sclerotherapy remains a cornerstone in the management of early-grade hemorrhoids. Among available sclerosants, 5% phenol in almond oil and 3% sodium tetradecyl sulphate (STS) are widely used, yet comparative evidence remains heterogeneous. The aim is to compare the efficacy, clinical outcomes, and safety profiles of 5% phenol in almond oil and 3% STS in Grade I and II internal hemorrhoids. **Materials and Methods:** A prospective interventional study was conducted on 60 patients randomized into two groups (n=30 each). Group A received 5% phenol in almond oil; Group B received 3% STS. Patients were followed up at 1, 3, 6, 12, and 18 weeks. Primary outcome was symptom resolution (bleeding and prolapse). Statistical analysis included chi-square test and independent t-test. **Result:** Early recovery was significantly higher in the phenol group (Week 1: 63.3% vs 0%, $p<0.001$; Week 3: 91.7% vs 0%, $p<0.001$). However, STS showed gradual improvement (Week 6: 33.3%, Week 12: 45%, Week 18: 90.9%). One patient (9.09%) in the STS group failed to respond. No major complications were observed. **Conclusion:** 5% phenol provides faster symptom relief, while STS demonstrates delayed but comparable long-term efficacy. Choice of sclerosant should be individualized based on clinical setting and follow-up feasibility.

INTRODUCTION

Hemorrhoids are vascular structures within the anal canal, traditionally described as cushion-like sinusoids that contribute to the mechanism of continence by aiding in the complete closure of the anal canal at rest.[1] These vascular cushions are typically located in three primary positions: left lateral, right anterior, and right posterolateral aspects of the anal canal. Secondary cushions may also exist in some individuals.[2] Hemorrhoidal disease arises when these cushions become symptomatic, often due to venous engorgement, thrombosis, or prolapse, leading to clinical features such as rectal bleeding, pain, or prolapse during defecation.[3] The underlying pathology frequently involves thrombosis of pre-sinusoidal arterioles and associated mucosal prolapse.[4]

Etiological factors contributing to the development of hemorrhoids are multifactorial.[6-8] They include chronic constipation, prolonged straining during defecation, sedentary lifestyle, obesity, pregnancy, aging, hereditary predisposition, vascular abnormalities, and elevated intra-abdominal pressure.[5]

Clinical assessment often includes digital rectal examination and anoscopy.[9] While early-grade internal hemorrhoids may not be palpable, prolapsed or thrombosed hemorrhoids can often be identified through physical examination or endoscopic evaluation.[10-12]

Various treatment strategies are available, ranging from conservative medical management to interventional procedures. For early-stage hemorrhoids (Grade I and II), non-surgical modalities are typically preferred. Rubber band ligation (RBL) has gained popularity for its simplicity and cost-

ISSN (O): 2687-5365; ISSN (P): 2753-6556

effectiveness.[13,14] Surgical hemorrhoidectomy is generally reserved for advanced cases (Grades III and IV), mixed hemorrhoids, or cases refractory to conservative treatments, particularly in patients who cannot undergo ligation due to anticoagulation or other contraindications.[15]

Sclerotherapy remains a cornerstone in the management of Grade I and II internal hemorrhoids, particularly in outpatient settings.[16-19] The technique involves the submucosal injection of a sclerosing agent, which induces localized inflammation and subsequent fibrosis, leading to mucosal adhesion and vascular obliteration.[20] Commonly used agents include 5% phenol in almond oil, 3% sodium tetradecyl sulfate (STS), hypertonic saline, and dextrose-based solutions.[21] Among these, 5% phenol in almond oil has long been considered a gold standard due to its availability, costeffectiveness, and safety profile.[22,23]

MATERIALS AND METHODS

This study was conducted at Maharishi Markandeshwar Medical College and Hospital, Solan. All patients attending the outpatient department or presenting to the emergency services with symptoms suggestive of hemorrhoidal disease were considered for inclusion. A per rectal and proctoscopic examination was performed to confirm the diagnosis. The degree, number, and position of hemorrhoids were recorded on a standardized proforma and outpatient case sheet.

This was a prospective interventional study carried out from October 2023 to March 2025. A total of 60 patients of both genders were enrolled. Patients were randomly assigned into two groups using the odd–even method. Group A (odd-numbered patients): Received 3% sodium tetradecyl sulfate for sclerotherapy. Group B (even-numbered patients): Received 5% phenol in almond oil.

Aims and objectives:

1. To compare efficacy of 3% sodium tetradecyl sulphate versus 5% phenol in almond oil in controlling the symptom of grade 1 and grade 2 hemorrhoids.
2. To assess clinical outcome of 3% sodium tetradecyl sulphate versus 5% phenol in almond oil versus in grade 1 and grade 2 hemorrhoids

Inclusion Criteria

1. Patients aged between 20 and 80 year.
2. Diagnosed with Grade I or Grade II internal hemorrhoids.
3. Provided informed consent for sclerotherapy

Exclusion Criteria

1. History of intolerance to sclerosant agents
2. Pregnancy
3. Severe cardiac disorders
4. Recent thrombotic episodes
5. Coexisting inflammatory anorectal conditions (e.g., anal fissure, fistula-in-ano, Crohn's disease, ulcerative colitis)
6. Acutely prolapsed or thrombosed piles
7. Bleeding diathesis
8. Grade III or IV hemorrhoids
9. Chronic liver disease or portal hypertension

Preparation of Sclerosants

1. 3% Sodium tetradecyl sulfate was administered at 1 mL per hemorrhoidal mass, with a maximum of 3 mL per sitting for up to three hemorrhoids.
2. 5% Phenol in almond oil was administered at 3 mL per hemorrhoid, with a maximum dose of 9 mL per session.

Follow-up

Patients were advised follow-up at:

- 1 week – for immediate post-procedural complications
- 3 weeks – for symptom review and possible reinjection
- 6 weeks – repeat assessment and reinjection if needed
- 12 weeks – follow-up for residual symptoms
- 18 weeks – final assessment

RESULTS

The study included a total of 60 patients, with 30 patients each in the 5% phenol in almond oil group and the 3% sodium tetradecyl sulfate group. The mean age of participants in the phenol group was 37.2 ± 5.32 years, while in the sodium tetradecyl sulfate group it was 38.3 ± 4.71 years. All participants in both groups were male (n = 30, 100%), with no female participants enrolled in the study. In terms of residence, the majority of participants in both groups belonged to rural areas—26 (86.67%) in the phenol group and 27 (90%) in the STS group. Urban residence was noted in 4 (13.33%) and 3 (10%) patients, respectively. In terms of residence, the majority of participants in both groups belonged to rural areas—26 (86.67%) in the phenol group and 27 (90%) in the STS group. Urban residence was noted in 4 (13.33%) and 3 (10%) patients, respectively. The groups were comparable based on rural-urban residence distribution (p = 0.112). The mean systolic blood pressure (SBP) in the 5% phenol in almond oil group was 121.93 ± 6.96 mmHg, compared to 125.8 ± 7.76 mmHg in the 3% sodium tetradecyl sulfate group. The difference in SBP between the groups was not statistically significant (p = 0.157), indicating comparability. The mean diastolic blood pressure (DBP) was 77.33 ± 8.01 mmHg in the phenol group and 77.73 ± 3.99 mmHg in the STS group. The groups were comparable in terms of DBP (p = 0.138). The pulse rate was 83.37 ± 6.07 beats per minute in the phenol group and 84.6 ± 3.68 beats per minute in the STS group. The difference between the two groups was not statistically significant (p = 0.192), suggesting similar baseline hemodynamic status.

Treat Outcomes at various weeks after treatment

At Week 1 of follow-up, 19 patients (63.33%) in the 5% phenol in almond oil group had recovered, while none of the patients (0%) in the 3% sodium tetradecyl

ISSN (O): 2687-5365; ISSN (P): 2753-6556

sulfate group showed recovery. In contrast, all 30 patients (100%) in the STS group were classified as not recovered, compared to 11 patients (36.67%) in the phenol group. The difference in outcomes at Week 1 between the groups was statistically significant ($p < 0.001$), indicating that the groups were not comparable at this time point.

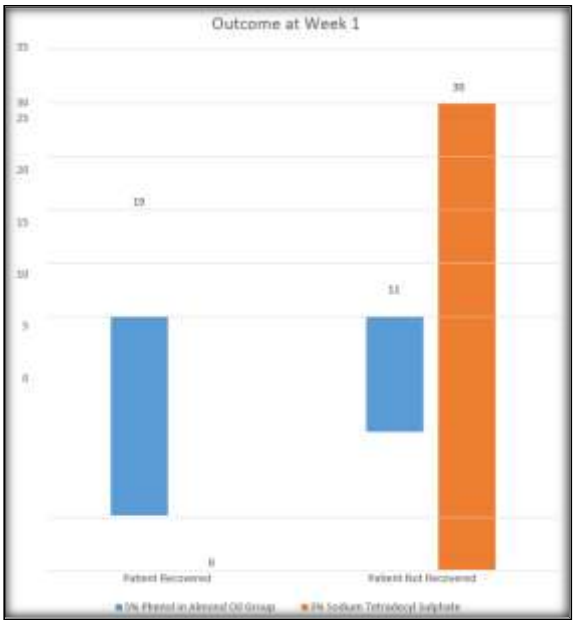

Figure 1: Outcome at Week 1 After Sclerotherapy

By Week 3, among the 12 patients who had not recovered in the phenol group and continued follow-up, 11 (91.67%) had recovered and only 1 patient (8.33%) remained unrecovered. In comparison, none of the 30 patients (0%) in the STS group had recovered by this time, with all 30 (100%) classified as not recovered. The difference in outcomes at Week 3 remained statistically significant ($p < 0.001$), again indicating non-comparability between groups.

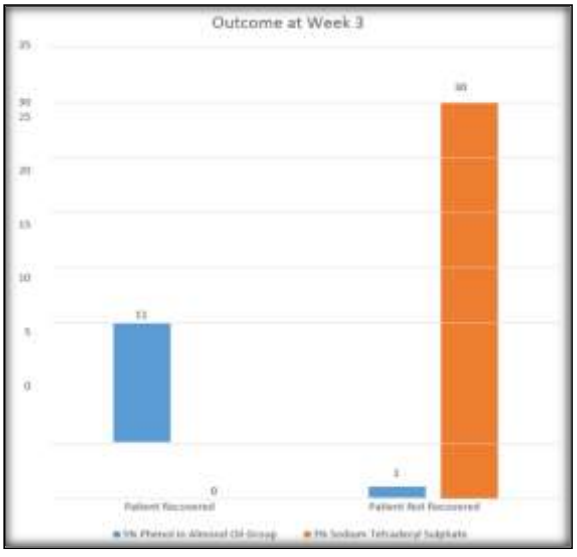

Figure 2: Outcome at Week 3 After Sclerotherapy

At Week 6, 10 patients (33.33%) in the STS group had recovered, while none were reported recovered in the phenol group at this point. In the STS group, 20 patients (66.67%) remained unrecovered, while in the phenol group only one patient was followed up, and this patient had not recovered (100%). The difference in recovery status between the two groups at Week 6 was not statistically significant ($p = 0.483$), suggesting comparable outcomes at this stage.

Figure 3: Outcome at Week 6 After Sclerotherapy

At Week 12, 9 patients (45%) in the STS group had recovered and 11 patients (55%) had not recovered. In the phenol group, only one patient was followed up, and this patient had not recovered (100%). The difference between the two groups at this stage was not statistically significant ($p = 0.375$), indicating group comparability.

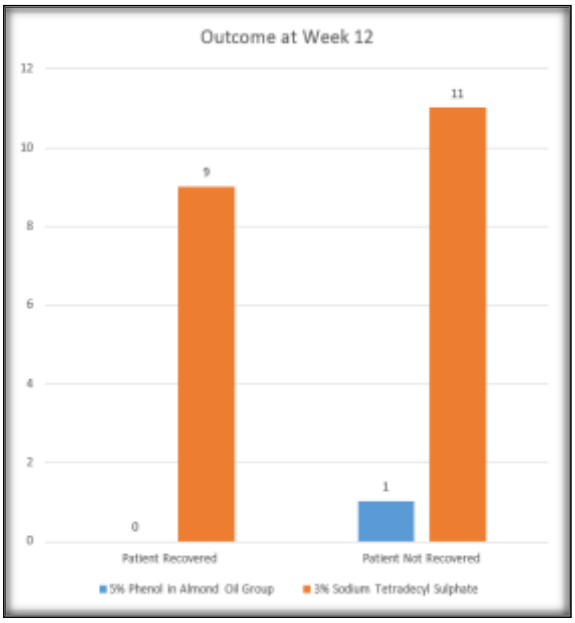

Figure 4: Outcome at Week 12 After Sclerotherapy

By Week 18, recovery was observed in 10 patients (90.91%) in the STS group, while 1 patient (9.09%) remained unrecovered. No patients from the phenol

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group were available for follow up at this point. Hence, statistical comparison was not applicable for this time point.

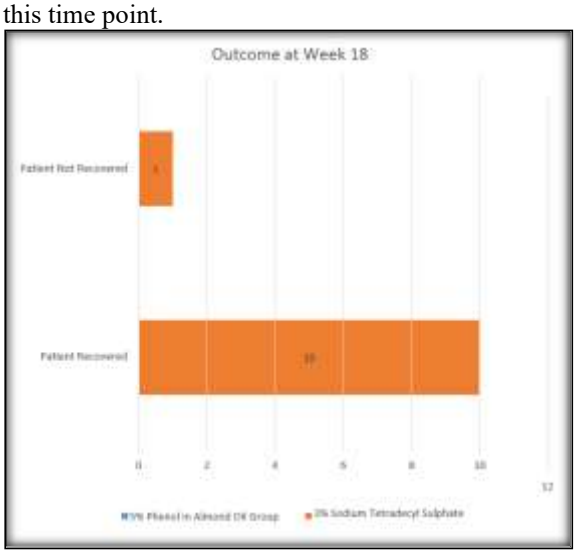

Figure 5: Outcome at Week 18 After Sclerotherapy

Cumulative analysis: In cumulative analysis, all 30 patients in the phenol group had recovered by Week 3. In contrast, recovery in the STS group occurred progressively, with 10 patients (33.33%) recovering by Week 6, 9 (45%) by Week 12, and 10 (90.91%) by Week 18. One patient (9.09%) in the STS group remained unrecovered at the end of the follow-up period.

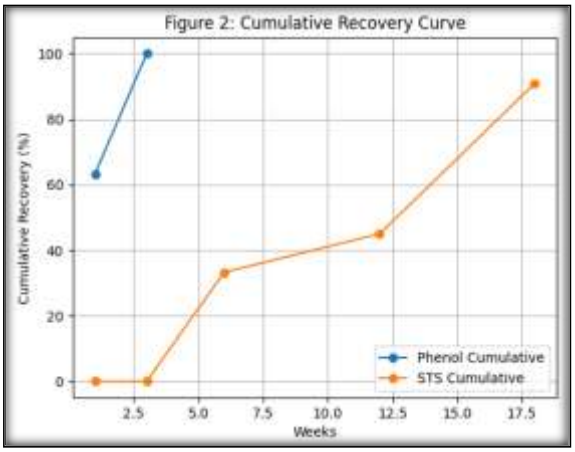

Table 1

	Treatment Group			
Patient Recovered	**5% Phenol in Almond Oil Group**		**3% Sodium Tetradecyl Sulphate**	
	n	**%**	**n**	**%**
Week 1	19	63.3%	0	-
Week 3	11	91.67%	0	-
Week 6	-	-	10	33.3%
Week 12	-	-	9	45%
Week 18	-	-	10	90.9%
Patient Not Recovered at all	-	-	1	9.09%
Total	30		30	100%

DISCUSSION

In this prospective observational study, the primary objective was to compare the effectiveness of 5% phenol in almond oil and 3% sodium tetradecyl sulphate (STS) in terms of symptom resolution in Grade I and Grade II internal hemorrhoids. By the end of Week 3, almost all patients in the phenol group had improved, whereas recovery in the STS group was delayed, with most patients requiring follow-ups till Week 12 or 18.

In addition to the primary comparison, our study also highlighted the pattern of gradual recovery observed among patients in the 3% STS group. While no patient in this group showed improvement by Week 1 or Week 3, a shift in response trend became evident at later stages. Around one-third of the patients (33.3%) had shown signs of recovery by Week 6, and this improved further to 45% by Week 12. The largest gain was seen by Week 18, where nearly 91% of the STS group had eventually recovered. This slow but steady improvement trajectory suggests that STS might be slower in onset but can still be effective over time. Though the early recovery was absent, outcomes over the long-term became more favourable for most cases.

It's worth mentioning that one patient in the STS group remained non-responsive even at Week 18, which was an exception in the otherwise improving trend. No additional symptoms or clinical worsening was recorded in that case, but absence of recovery raised the possibility of procedure failure or possible technique-related issue, though this couldn't be fully confirmed. It is also possible that some degree of subjective bias or symptom persistence was involved in that patient, but again we didn't had enough follow up tools to explore that further. Overall, even though the phenol group had early benefits, the STS group showed a catch-up trend that deserves consideration for certain patient types or clinical setups.

Sclerotherapy has long been accepted as a minimally invasive modality for managing early-grade internal hemorrhoids, especially Grades I and II, and is frequently preferred in outpatient practice due to its ease of administration and low-cost nature.

Our findings in terms of faster symptomatic improvement in the phenol group appear to be largely consistent with previous observations by Sankhala et al. (2018), who reported favourable outcomes with phenol-based sclerosant in the management of low-grade hemorrhoids.[24] On the other hand, our STS group results are also broadly supported by studies

ISSN (O): 2687-5365; ISSN (P): 2753-6556

like Alvi et al. (2023) and Garrido et al. (2024).[25,26] Both studies showed that 3% STS, while slower in action, led to good medium-term symptom resolution without major complications. In Alvi's study, complete resolution rates were higher after six weeks, while Garrido's multicentric audit noted that STS produced consistent results between 6 to 12 weeks when administered properly. Our own data reflects similar pacing, as most STS patients required extended follow-up for full resolution. The lack of early effect doesn't imply inefficacy, but rather points to different pharmacologic behavior and possibly slower onset of mucosal sclerosis. That pattern was also evident in STS groups in above studies, though exact timeline varied depending on centre, formulation and skill of operator (Alvi et al. 2023; Garrido et al. 2024).

The volume of sclerosant used may also be a determining variable. Although our protocol defined 1cc for STS and 3cc for phenol per site, it is likely that retention time, diffusion, and local contact area varied across sittings.

Clinical Implications

The findings of this study have direct practical relevance:

Phenol is preferable when:

- Rapid symptom relief is required
- Patient follow-up is uncertain
- High patient turnover exists (e.g., government hospitals)

STS is preferable when:

- Long-term follow-up is feasible
- A gradual, controlled response is acceptable
- There is concern about tissue irritation or complications

Safety Profile

No major complications were observed in either group, indicating that both agents are safe when administered correctly. The absence of adverse events such as ulceration, necrosis, or severe pain highlights the procedural safety of injection sclerotherapy in experienced hands.

Comparison with Existing Literature

The findings of this study are consistent with previous literature:

- Studies on phenol have demonstrated rapid symptomatic relief, particularly in early-stage hemorrhoids
- STS has been shown to provide effective sclerosis with a more gradual onset
- Overall efficacy rates reported in literature for both agents range between 80–95%, aligning with the outcomes observed in this study

However, direct comparative data remain limited, and this study contributes valuable evidence in this regard.

Strengths of the Study

- Prospective design
- Direct head-to-head comparison
- Uniform technique and follow-up protocol
- Focus on clinically relevant endpoints

Limitations

- Small sample size (n=60)
- Male-only population (limits generalizability)
- Lack of blinding (potential observer bias)
- Absence of standardized symptom scoring system
- Shorter follow-up for phenol group after complete recovery

Future Directions

Further studies should focus on:

- Larger multicentric randomized controlled trials
- Inclusion of female patients
- Long-term recurrence rates
- Patient-reported outcome measures (PROMs)
- Cost-effectiveness analysis

CONCLUSION

The present prospective comparative study evaluated the efficacy and safety of 5% phenol in almond oil versus 3% sodium tetradecyl sulphate (STS) as sclerosants in the management of Grade I and II internal hemorrhoids.

The findings demonstrate that both agents are effective, safe, and well-tolerated, with no major complications observed in either group. However, a clear difference in the temporal pattern of therapeutic response was identified.

5% phenol in almond oil was associated with rapid onset of action, with a significant proportion of patients achieving symptomatic relief as early as the first week, and near-complete resolution by the third week. This makes phenol particularly advantageous in clinical settings where early symptom control is essential, such as high-volume outpatient departments or in patients with limited follow-up compliance.

In contrast, 3% sodium tetradecyl sulphate exhibited a delayed but progressive therapeutic response, with gradual improvement over subsequent follow-ups and achieving comparable recovery rates by the end of the study period. This suggests that STS provides a controlled and sustained sclerosing effect, making it a viable alternative when long-term follow-up is feasible.

Importantly, despite differences in early outcomes, the final efficacy of both agents was comparable, indicating that the choice of sclerosant does not significantly influence the ultimate treatment success but rather affects the speed of recovery.

From a clinical perspective, these findings support an individualized approach to sclerosant selection:

- Phenol is preferable when rapid symptom relief and early discharge are priorities
- STS may be considered when gradual resolution and structured follow-up are acceptable

Thus, injection sclerotherapy using either agent remains a valuable, minimally invasive, and cost-effective modality for the treatment of early hemorrhoidal disease.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

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ISSN (O): 2687-5365; ISSN (P): 2753-6556