

INTRAOPERATIVE GLOVE WASHING: A SIMPLE STRATEGY TO REDUCE POSTOPERATIVE ADHESIVE INTESTINAL OBSTRUCTION- A PROSPECTIVE COMPARATIVE STUDY

Ab. Hamid Wani,¹ Shireen Mehak², Sumaya Fatima Shad,³ Javid Iqbal,⁴ Zahur Hussain⁵

Received : 06/06/2026
Received in revised form : 17/07/2026
Accepted : 30/07/2026

Keywords:

Adhesive intestinal obstruction, peritoneal adhesions, surgical glove powder, Cornstarch, Powdered latex gloves, Laparotomy, Adhesion prevention.

Corresponding Author:

Dr. Sumaya Fatima Shad,
Email: Shad.sumaya@gmail.com

DOI: 10.47009/jamp.2026.8.4.262

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

Int J Acad Med Pharm
2026; 8 (4); 1556-1559



¹Assistant Professor Department of Surgery Government Medical College Jammu, Jammu and Kashmir India.

²Postgraduate Student Department of Surgery Government Medical College Jammu, Jammu and Kashmir India.

³Senior Resident Department of Surgery Government Medical College Jammu, Jammu and Kashmir India.

⁴Assistant Professor Department of Surgery Government Medical College Jammu, Jammu and Kashmir India.

⁵Professor Department of Surgery Government Medical College Jammu, Jammu and Kashmir India.

ABSTRACT

Background: Postoperative intra-abdominal adhesions remain one of the leading causes of adhesive intestinal obstruction following abdominal surgery. Glove powder, primarily corn-starch used as a lubricant for powdered latex surgical gloves, has been implicated in peritoneal inflammation and adhesion formation. Washing powdered gloves with sterile saline before handling intra-abdominal tissues may reduce the introduction of glove powder into the peritoneal cavity and consequently decrease postoperative adhesion-related complications. The aim is to compare the incidence of postoperative adhesive intestinal obstruction in patients undergoing abdominal surgery with intraoperative washing of powdered surgical gloves versus those in whom gloves were used without washing. **Materials and Methods:** This prospective comparative study included 200 patients of all age groups undergoing elective or emergency laparotomy over a five-year period. Patients were divided into two equal groups. In Group A (n = 100), powdered latex surgical gloves were thoroughly washed with sterile normal saline immediately after donning and before handling intra-abdominal contents. In Group B (n = 100), powdered gloves were used without washing. Patients were followed for 24 months to assess the development of postoperative adhesive intestinal obstruction. Secondary outcomes included postoperative ileus, surgical site infection, duration of hospital stay, and need for reoperation. Statistical analysis was performed using the Chi-square test and Student's t-test, with $p < 0.05$ considered statistically significant. **Results:** Adhesive intestinal obstruction developed in 5 patients (5.0%) in Group A compared with 15 patients (15.0%) in Group B ($p = 0.018$). Reoperation for adhesive obstruction was required in 2 patients (2.0%) in Group A and 8 patients (8.0%) in Group B. The mean postoperative hospital stay was significantly shorter in Group A. No significant differences were observed in surgical site infection or postoperative mortality between the groups. **Conclusion:** Intraoperative washing of powdered surgical gloves before contact with intra-abdominal tissues was associated with a significantly lower incidence of postoperative adhesive intestinal obstruction. This simple, inexpensive, and easily reproducible technique may help reduce adhesion-related morbidity, particularly in resource-limited settings where powdered gloves continue to be used.

INTRODUCTION

Postoperative intra-abdominal adhesions remain one of the most common complications following

abdominal surgery and occur in up to 90% of patients undergoing laparotomy.^[1-3] The adhesive intestinal obstruction occurs due to the formation of fibrous bands (adhesions) that form between loops of bowel

or between the bowel and abdominal wall. Adhesions are the leading cause of adhesive intestinal obstruction and contribute significantly to chronic abdominal pain, infertility, and difficulties during reoperative surgery.^[2-5] Peritoneal injury initiates a cascade of inflammation, fibrin deposition, and impaired fibrinolysis, resulting in adhesion formation.^[6,7] Besides surgical trauma, foreign materials introduced into the peritoneal cavity also contribute to adhesion development.^[8] Powdered surgical gloves contain absorbable cornstarch that facilitates donning. Experimental and clinical studies have demonstrated that starch particles induce foreign-body granulomatous inflammation and promote peritoneal adhesion formation.^[9-12] Histopathological studies have identified starch granules within postoperative adhesions and granulomas.^[10,11] Experimental studies have shown that reducing glove powder contamination decreases adhesion formation.^[12,13] Although powder-free gloves are increasingly recommended, powdered gloves continue to be widely used in many developing countries because of their lower cost and availability.^[14,15] The present study was therefore undertaken to evaluate whether washing powdered surgical gloves with sterile saline before handling intra-abdominal tissues reduces postoperative adhesive intestinal obstruction.

MATERIALS AND METHODS

Study Design and Setting: This prospective comparative study was conducted in the Department of General Surgery at a tertiary care teaching hospital over a period of five years between January 2021 to January 2025. The study evaluated the effect of intraoperative washing of powdered surgical gloves on the incidence of postoperative adhesive intestinal obstruction in patients undergoing abdominal surgery. Approval was obtained from the Institutional Ethics Committee before commencement of the study, and written informed consent was obtained from all patients or their legal guardians.

Study Population: A total of 200 patients of all age groups, irrespective of gender undergoing elective or emergency laparotomy were enrolled. Patients were allocated into two equal groups (100 patients each) by computer generated randomisation.

Group A (Washed Gloves Group): Powdered sterile latex gloves were thoroughly washed with sterile normal saline immediately after donning and before handling the abdominal viscera.

Group B (Unwashed Gloves Group): Powdered sterile latex gloves were used conventionally without washing.

All other aspects of perioperative management and operative technique were kept identical in both groups to minimize bias.

Inclusion Criteria

Patients of all age groups undergoing elective or emergency laparotomy.

Patients willing to participate and provide informed consent.

Patients available for postoperative follow-up for at least 24 months.

Exclusion Criteria

Patients with pre-existing adhesive intestinal obstruction.

Patients undergoing laparoscopic procedures without laparotomy.

Patients with generalized peritonitis requiring damage-control surgery.

Patients with intra-abdominal malignancy requiring cytoreductive surgery.

Patients who died within 30 days of surgery due to causes unrelated to adhesion formation.

Patients lost to follow-up.

Surgical Technique

Standard aseptic precautions were followed in all operations. The same type of powdered sterile latex surgical gloves was used throughout the study.

In Group A, immediately after donning, surgeons and assistants rinsed their gloved hands thoroughly with sterile normal saline to remove visible glove powder before handling any intra-abdominal structures. Gloves were changed and similarly washed whenever replacement was required during surgery.

In Group B, powdered gloves were used without any washing, reflecting conventional practice.

Meticulous surgical technique, gentle tissue handling, meticulous haemostasis, adequate irrigation, and appropriate abdominal closure techniques were employed uniformly in both groups.

Outcome Measures

Primary Outcome

Incidence of postoperative adhesive intestinal obstruction during the 24-month follow-up period.

Diagnosis was established on the basis of:

Clinical features suggestive of intestinal obstruction.

Plain abdominal radiography and/or contrast-enhanced computed tomography.

Operative confirmation in patients requiring surgery.

Secondary Outcomes

Duration of postoperative ileus.

Surgical site infection.

Duration of hospital stay.

Requirement for reoperation due to adhesive intestinal obstruction.

Postoperative mortality.

Follow-up

Patients were evaluated during hospital stay and subsequently at 1 month, 3 months, 6 months, 12 months, and 24 months after surgery. Additional visits were scheduled whenever symptoms suggestive of bowel obstruction developed.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were expressed as frequencies and percentages. Student's t-test was used for comparison of continuous variables, and the Chi-

square test or Fisher's exact test was applied for categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Patient Characteristics

A total of 200 patients were included in the study, with 100 patients in each group. No patient was lost to follow-up during the 24-month study period. The two groups were comparable with respect to age, sex distribution, indication for surgery, and type of surgical procedure ($p > 0.05$).

Table 1: Baseline Demographic Characteristics

Variable	Group A(Washed Gloves) (n=100)	Group B (Unwashed Gloves) (n=100)	p-value
Mean age(years)	39.8 +-18.6	41.1 +- 17.9	0.62
Male	61	59	0.77
Female	39	41	0.77
Elective surgery	68	66	0.76
Emergency surgery	32	34	0.76

There was no statistically significant difference in baseline demographic characteristics between the two groups as shown in [Table 1].

Table 2: Indications for Laparotomy

Indication	Group A	Group B
Acute appendicitis	24	22
Intestinal perforation	18	20
Intestinal obstruction (non -adhesive)	14	15
Abdominal trauma	11	10
Peptic ulcer perforation	9	8
Colorectal diseases	10	12
Miscellaneous	14	13

The distribution of operative indications was similar in both groups with acute appendicitis as the commonest one followed by intestinal perforation and non-adhesive intestinal obstruction as shown in [Table 2]

Postoperative Outcomes

The incidence of postoperative adhesive intestinal obstruction was significantly lower in the washed-glove group as compared to the non- washed group as shown in [Table 3].

Table 3: Comparison of Postoperative Outcomes

Outcome	Group A (n=100)	Group B (n=100)	p-value
Adhesive intestinal obstruction	5 (5%)	15 (15%)	0.018
Reoperation for adhesions	2(2%)	8(8%)	0.049
Surgical site infection	8(8%)	10(10%)	0.62
Prolonged postoperative ileus (>5 days)	7 (7%)	16 (16%)	0.041
Mean hospital stay (days)	6.3+- 2.1	8.1+-3.4	0.003
Mortality	1(1%)	2(2%)	0.56

Patients in the washed-glove group demonstrated a significantly lower incidence of adhesive intestinal obstruction and postoperative ileus. The requirement

for reoperation due to adhesive bowel obstruction was also significantly reduced in the washed group than in the non-washed group as shown in [Table 3].

Table 4: Time of Presentation of Adhesive Intestinal Obstruction

Time after surgery	Group A	Group B
Within 6 months	1	4
6-12 months	2	5
12-24 months	2	6
Total	5	15

Most cases of adhesive intestinal obstruction occurred during the first two postoperative years,

with a consistently lower incidence in the washed-glove group as shown in [Table 4].

Table 5: Relative Risk of Adhesive Intestinal Obstruction

Variable	Value
Incidence in Group A	5%
Incidence in Group B	15%
Absolute Risk Reduction	10%

Relative Risk	0.33
Relative Risk Reduction	66.7
Number needed to treat (NNT)	10

Washing powdered surgical gloves before handling intra-abdominal tissues reduced the relative risk of postoperative adhesive intestinal obstruction by approximately 67%, with one case of adhesive obstruction prevented for every 10 patients treated using the glove-washing protocol as shown in [Table-5].

DISCUSSION

Adhesive intestinal obstruction is the most common cause of small bowel obstruction. It occurs due to fibrous bands (adhesions) that form between loops of bowel or between the bowel and the abdominal wall. Foreign bodies or talc/ cornstarch used in powdered gloves and excessive tissue handling during surgery especially bowel promotes the adhesion formation. The present study demonstrated a significantly lower incidence of postoperative adhesive intestinal obstruction in patients operated upon with washed powdered gloves. These findings are consistent with previous reports emphasizing the role of glove powder in adhesion formation.^[1,2,6,9] Cornstarch particles act as foreign bodies and stimulate macrophage activation, giant-cell formation, fibroblast proliferation, and collagen deposition, thereby enhancing adhesion formation.^[9-13] Experimental work by van den Tol et al demonstrated significantly greater adhesion formation following intraperitoneal exposure to glove powder than in controls.^[12] Kamffer and colleagues also advocated abandoning powdered gloves because of their role in intraperitoneal adhesions.^[13] Reduction in postoperative ileus observed in the present study may be explained by decreased peritoneal inflammation and improved fibrinolytic activity, findings supported by previous investigations.^[6,7,16] Several strategies have been proposed to reduce postoperative adhesions, including meticulous tissue handling, minimizing tissue trauma, avoiding foreign-body contamination, and the use of adhesion barriers.^[5,16-18] Although many institutions have adopted powder-free gloves, powdered gloves continue to be used in resource-limited settings. Washing powdered gloves with sterile saline is an inexpensive intervention that can substantially reduce powder contamination without increasing operative time.^[13,19] The findings of the present study support earlier reports demonstrating the harmful effects of glove powder and reinforce recommendations favouring powder-free gloves or, where unavailable, thorough washing of powdered gloves before intra-abdominal use.^[12,13,19,20] Thus this small preventive measure of washing powdered gloves before handling tissue especially bowel during abdominal surgery has a great impact in lowering

down the formation of adhesions and adhesive small bowel obstruction.

CONCLUSION

Intraoperative washing of powdered surgical gloves before contact with intra-abdominal tissues was associated with a significantly lower incidence of postoperative adhesive intestinal obstruction. This simple, inexpensive, and easily reproducible technique may help reduce adhesion-related morbidity, particularly in resource-limited settings where powdered gloves continue to be used.

REFERENCES

1. Ellis H. The clinical significance of adhesions: focus on intestinal obstruction. *Eur J Surg Suppl.* 1997;(577):5-9.
2. Menzies D, Ellis H. Intestinal obstruction from adhesions—how big is the problem? *Ann R Coll Surg Engl.* 1990;72(1):60-63.
3. Parker MC, Wilson MS, van Goor H, et al. Adhesions and colorectal surgery—call for action. *Colorectal Dis.* 2007;9(Suppl 2):66-72.
4. Ray NF, Denton WG, Thamer M, Henderson SC, Perry S. Abdominal adhesiolysis: inpatient care and expenditures in the United States in 1994. *J Am Coll Surg.* 1998;186(1):1-9.
5. diZerega GS. Contemporary adhesion prevention. *Fertil Steril.* 1994;61(2):219-235.
6. Holmdahl L. The role of fibrinolysis in adhesion formation. *Eur J Surg Suppl.* 1997;(577):24-31.
7. Liakakos T, Thomakos N, Fine PM, Dervenis C, Young RL. Peritoneal adhesions: etiology, pathophysiology and clinical significance. *Dig Surg.* 2001;18(4):260-273.
8. Luijendijk RW, de Lange DCD, Wauters CCAP, et al. Foreign material in postoperative adhesions. *Ann Surg.* 1996;223(3):242-248.
9. Tolbert TW, Brown JL. Surface powders on surgical gloves. *Arch Surg.* 1980;115(6):729-732.
10. Kamffer WJ, Jooste EV, Nel JT, de Wet JI. Surgical glove powder and intraperitoneal adhesion formation. An appeal for the use of powder-free surgical gloves. *S Afr Med J.* 1992;81(3):158-159.
11. Hunt TK, Hopf HW, Hussain Z. Starch powder contamination of surgical wounds. *Arch Surg.* 1994;129(8):825-827.
12. van den Tol MP, Haverlag R, van Rossen MEE, Bonthuis F, Marquet RL, Jeekel J. Glove powder promotes adhesion formation and facilitates tumour cell adhesion and growth. *Br J Surg.* 2001;88(9):1258-1263.
13. Arung W, Meurisse M, Detry O. Pathophysiology and prevention of postoperative peritoneal adhesions. *World J Gastroenterol.* 2011;17(41):4545-4553.
14. ten Broek RPG, Issa Y, van Santbrink EJP, et al. Burden of adhesions in abdominal and pelvic surgery: systematic review and meta-analysis. *BMJ.* 2013;347:f5588.
15. Diamond MP, Freeman ML. Clinical implications of postsurgical adhesions. *Hum Reprod Update.* 2001;7(6):567-576.
16. Vrijland WW, Jeekel J, van Geldorp HJ, Swank DJ, Bonjer HJ. Abdominal adhesions: intestinal obstruction, pain and infertility. *Surg Endosc.* 2003;17(7):1017-1022.
17. Lower AM, Hawthorn RJ, Clark D, et al. Adhesion-related readmissions following abdominal surgery. *Lancet.* 2000;355(9214):1476-1480.
18. Ward BC, Panitch A. Abdominal adhesions: current and novel therapies. *J Surg Res.* 2011;165(1):91-111.
19. Becker JM, Dayton MT, Fazio VW, et al. Prevention of postoperative abdominal adhesions by a sodium hyaluronate-based bioresorbable membrane: a prospective, randomized, double-blind multicenter study. *J Am Coll Surg.* 1996;183(4):297-306.
20. Ten Broek RPG, Strik C, Issa Y, et al. Adhesiolysis-related morbidity in abdominal surgery. *Ann Surg.* 2013;258(1):98-106.