International Surgery Journal
Ghritlaharey RK. Int Surg J. 2026 Dec;13(12):xxx-xxx
https://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20264256

Systematic Review

Extrusion of ventriculoperitoneal shunt catheters through natural orifices: a comprehensive literature review

Rajendra K. Ghritlaharey*

Department of General Surgery, Mahaveer Institute of Medical Sciences and Research, Badwai, Bhopal, Madhya Pradesh, India

Received: 05 October 2026
Revised: 03 November 2026
Accepted: 12 November 2026

***Correspondence:**
Dr. Rajendra K. Ghritlaharey,
E-mail: drrajendrak1@rediffmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Ventriculoperitoneal shunt (VPS) catheter insertion, performed to treat hydrocephalus, is associated with several complications. The objectives of this study were to review, analyze, and summarize the published literature for demographics, clinical characteristics, and outcomes of surgical therapy provided for the extrusion of VPS catheter through natural orifices. An online database search was performed using various keywords to retrieve relevant published literature/manuscripts, and were searched from 1973 to December 31, 2025. This review included n=384 cases of VPS catheter extrusion (trans-anal n=292, trans-oral n=41, trans-urethral n=31, and trans-vaginal n=20) and comprised n=221 (57.55%) males and n=163 (42.44%) females. Their age at the time of diagnosis of extrusion of the VPS catheter through natural orifices was under 5 years in 72% of cases. In two-thirds of cases, the above-mentioned complication was reported within 12 months of VPS insertion or shunt revision, if any. The chief complaint was extrusion of the distal VPS catheter through natural orifices. In four-fifths of cases, removal of the entire/distal VPS catheters with or without external ventricular drainage (EVD) was preferred. The extrusion of VPS catheters through natural orifices occurred across all ages. In 72% of cases, the age of cases at the time of the diagnosis of VPS catheter extrusion was ≤ 5 years. Removal of the entire/distal VPS catheters, with or without EVD, was the most frequently preferred surgical procedure. Repair of perforated hollow viscera, including the stomach, small and large bowel, urinary bladder, or uterus, was performed in only one-fourth of cases.

Keywords: Complication, Extrusion, Hydrocephalus, Infants, Pediatrics, Protrusion, Ventriculoperitoneal shunt

INTRODUCTION

Hydrocephalus is a clinical condition characterized by an imbalance between the production and absorption of cerebrospinal fluid (CSF), with various underlying etiologies.[1,2] One of the most commonly accepted and performed neurosurgical procedures for treating hydrocephalus across all ages is the diversion of CSF from the ventricular system to the peritoneal cavity through the insertion of a VPS catheter.[3,4] However, there are numerous complications associated with the insertion of a VPS catheter.[5,6] These complications can include infections, obstruction, malfunctions, migration of the catheter into and through various body parts, visceral perforation, and perforation of hollow viscera.[5-9] Perforation of the hollow viscera (stomach, small and large bowel, urinary bladder, and uterus by the distal VPS catheter is one of the serious complications and clinically may present with extrusion or without extrusion of the shunt catheter through the natural orifices.[10-13] Among these complications, perforation of the colon/large bowel, followed by the extrusion of the distal VPS catheter through the anal canal (trans-anal extrusion), is more common than perforation of other hollow organs.[10-13] The paper adheres to the preferred reporting items for systematic reviews and meta-analyses (PRISMA)

guidelines for reporting this article.[14] Since this article is a review of previously published literature, it does not require institutional ethical review or clearance. This review analyzes data obtained from literature concerning on 384 cases in which patients presented with extrusion of distal VPS catheters through various natural orifices.[8,9,15-68] This review includes 292 cases of trans-anal extrusion of the distal VPS catheters.[8,9,15,19-47] Trans-oral extrusion of the distal VPS shunt catheter includes 41 cases.[16,48-57] Trans-urethral extrusion of the distal VPS shunt catheter includes 31 cases.[17,58-63] Additionally, in 20 of the included cases, the distal VPS catheter extruded trans-vaginally.[18,64-68] This review encompasses 288 manuscripts; however, only selected references are cited in the text due to the extensive literature.[8,9,15-68]

Furthermore, 35 manuscripts, including 73 cases of VPS catheter extrusion through natural orifices were excluded from this review for various reasons, and only a few references are listed.[69-75] The objective of this review were to review, analyze, and summarize the published literature concerning the demographics, clinical characteristics, and outcomes of surgical therapy for VPS catheter extrusion via natural orifices.

METHODS

This manuscript provides a comprehensive review of global literature on the management of distal VPS catheter extrusion through natural orifices, including trans-anal, trans-oral, trans-urethral, and trans-vaginal routes. An extensive online database search was performed using various keywords to identify pertinent literature on VPS catheter extrusion via the natural orifices. Databases searched included PubMed, PMC or PubMed Central, Scopus, Web of Science, Cochrane Library, ResearchGate, Google Scholar, and the Google Images. PRISMA guidelines were followed when preparing this manuscript. As this manuscript is a review and analysis of data obtained from the previously published cases, institutional ethical committee approval was not required.

Study duration

The maiden cases of trans-anal, trans-oral, trans-urethral, and trans-vaginal extrusion of the distal VPS catheter were published in the years 1973, 1987, 1982, and 1973, respectively.[15-18] The literature search covered publications from those years up to December 31, 2025.

Search keywords

During the search, various keywords were employed either individually or in combination. Some of the keywords used include “extrusion or protrusion of VPS catheter through the anus, rectum, mouth, urethra, or vagina”, “transanal/transoral/transurethral or transvaginal extrusion of distal ventriculoperitoneal or peritoneal shunt catheter”, “hollow visceral perforation by peritoneal shunt catheter”, “migration of distal shunt catheter”, and “rare or unusual extrusion or complication of VPS catheter”.

Literature selection process

The initial selection of manuscripts was conducted by evaluating the titles and abstracts. The final selection of the manuscripts for this review was based on a brief assessment of the full text. As this manuscript is authored by a single person, the selection of manuscripts for review, the extraction of relevant case details, tabulation, interpretation of findings, and manuscript writing were all carried out solely by the corresponding author.

A few of the literature/case reports published and available in languages other than English were also incorporated for review, and the same were translated into English using “Google Translate”, and the required details were extracted.

Inclusion criteria

Manuscripts consisting of cases of extrusion of the VPS catheter through various natural orifices, published preferably in English, were included in the review. A few of the cases that had extrusion of the distal end of either a duro-peritoneal/ subduro-peritoneal shunt or cysto-peritoneal shunt have also been included in this review. A few of the manuscripts consisting of cases of extrusion of the VPS catheter through various natural orifices, published and available in languages other than English, were also incorporated in the review.

Exclusion criteria

Cases/literature describing/consisting of extrusion of the lumbo-peritoneal shunt catheter through various natural orifices were excluded. Literature/articles describing the cases/reports on the perforation of the hollow viscera (stomach, small and large bowel, urinary bladder, and uterus) by the peritoneal catheter, but without the extrusion of the VPS catheters through natural orifices, were excluded from the review.

The manuscripts/literature regarding extrusion of the VPS catheter through various natural orifices, obtained through electronic search, but without the complete or missing desired details, unpublished reports, and conference proceedings were excluded from the review.

Categorization of cases

The cases were grouped into four groups: Group A, Group B, Group C, and Group D. Group A: Trans-anal extrusion of the distal VPS catheter, Group B: Trans-oral extrusion of the distal VPS catheter, Group C: Trans-urethral extrusion of the distal VPS catheter, and Group D: Trans-vaginal extrusion of the distal VPS catheter.

Variables extracted from the literature/reports

Details of the literature itself, the age and sex of the included cases, causes of hydrocephalus, indication for the initial or primary VPS catheter insertion, the time interval, clinical characteristics, various radiological investigations done, surgical therapy provided for the management of extruded VPS catheter, techniques utilized by the authors, and the outcomes of the surgical therapy performed.

Definition for current review

The initial or primary VPS catheter insertion or implantation is defined as the VPS catheter insertion done for the first time. The interval is the duration calculated from primary VPS catheter insertion to the diagnosis/management of the extrusion of the VPS catheter through the natural orifices. For the cases that had received shunt revision, the interval was calculated from the last VPS revision to the diagnosis/management of the extrusion of the VPS catheter through natural orifices.

Statistical calculation

The results obtained were interpreted and presented in numbers, mean, SD (standard deviation), and percentages.

References

This review is based on a total of n=288 manuscripts, but only selected references are provided/listed, as the complete list is lengthy. For Group A cases, the manuscripts that include the historical first report, describing three or more cases, a few of the manuscripts describing the cases with clinical features with meningitis or peritonitis, and manuscripts that included cases that died during the postoperative period, are listed. For Group B, Group C, and Group D cases, the manuscripts that include the historical first report, a few of the manuscripts describing the cases with clinical features with meningitis or peritonitis, and manuscripts that included cases that died during the postoperative period, and a few others are listed. Additionally, n=35 manuscripts comprising n=73 cases of VPS catheter extrusion through natural orifices were excluded from this review for various reasons, and only a few of the manuscripts are listed (all the excluded references are also not listed) in the references. Full list of references (n=288) for included cases and all the references (n=35) for excluded cases is available with the corresponding author and can be provided/obtained on reasonable ground.

RESULTS

The PRISMA flow diagram illustrating the manuscript selection process for reviewing the literature on managing the extrusion of VPS catheters through natural orifices is presented/detailed in Figure 1. An online database search identified n=457 cases of VPS catheter extrusion through natural orifices, as detailed in Figure 2. A total of n=288 manuscripts were qualified and selected for the literature review. The yearly and group-wise details of the literature included for review are presented in Figure 3. Half (n=146) of the manuscripts included for review were contributed by four countries, namely: India, Turkey, the USA, and the UK. Figure 4 details the countries affiliated with published works on managing VPS catheter extrusion through natural orifices. Figure 4 depicts the names of authors' countries that had published a minimum of 4 or more such manuscripts during the study period. Among n=288 manuscripts reviewed; three-fourths (n=220) were published as case report(s). Thirty-five manuscripts, comprising a total of n=73 cases of VPS catheter extrusion through the natural orifices, were excluded from the current review for various reasons. Figure 5 shows the number of cases included (trans-anal, trans-oral, trans-urethral, and trans-vaginal extrusion of VPS catheters) for review of the world literature. This review included a total of n=384 cases of distal VPS catheter extrusion through natural orifices, with trans-anal extrusion being the most frequently reported than others. This review of global literature on the management of distal VPS catheter extrusion through natural orifices included n=384 cases, comprising n=221 (57.55%) males and n=163 (42.44%) females. Of these, three-fourths (n=292; 183 males and 109 females) cases involved extrusion of the distal VPS catheters through the anal canal. The remaining cases were categorised as trans-oral extrusion n=41; 10.67% (23 males and 18 females), trans-urethral extrusion n=31; 8.07% (15 males and 16 females), and trans-vaginal extrusion n=20; 5.2% of VPS catheters. Figure 6 provides the indications for initial VPS catheter insertion for all cases included in the review. For two-thirds (n=256) of cases, the indication for initial VPS catheter insertion was hydrocephalus caused by congenital pathologies. Figure 7 outlines the ages of patients at the time of initial shunt catheter insertion and at the diagnosis of VPS catheter extrusion through natural orifices. The initial VPS catheters were implanted during infancy in 64% (n=246) of the cases. More than two-thirds (n=278) of the cases were ≤5 years old at the time of diagnosis of this complication. In two-thirds (n=261) of the cases, extrusion of the distal VPS catheters through natural orifices occurred within 12 months following initial shunt implantation or the last shunt revision, if performed. The interval from initial or primary VPS insertion or last shunt revision to the diagnosis of VPS catheter extrusion for the various groups of cases included for review is detailed in Figure 8. The extrusion of the distal shunt catheter through natural orifices was the primary/chief complaint in most of the cases reviewed. Some cases also had associated features suggestive of meningitis and peritonitis. On clinical examination, extruded distal VPS catheters were detected in n=343; 89.32% cases. Surgical procedures performed for VPS catheter extrusion through natural

orifices are detailed in Figure 9. Authors frequently performed the removal of either the entire or distal part of the VPS catheter, with or without EVD. For shunt revisions, delayed re-insertion of the VPS catheter was preferred in n=138 of n=250 cases requiring a revision procedure. For the remaining cases, other operative procedures were followed. The surgical procedures preferred and provided for extrusions of the VPS catheter through natural orifices yielded positive outcomes. Mortality was reported in n=16 (4.16%) of the cases reviewed. Demographic and other details of the cases that died during the management of VPS catheter extrusion through the natural orifices are detailed in Table 1. A comparative summary of the results from the literature review regarding the extrusion of VPS catheters through natural orifices is provided in Table 2.

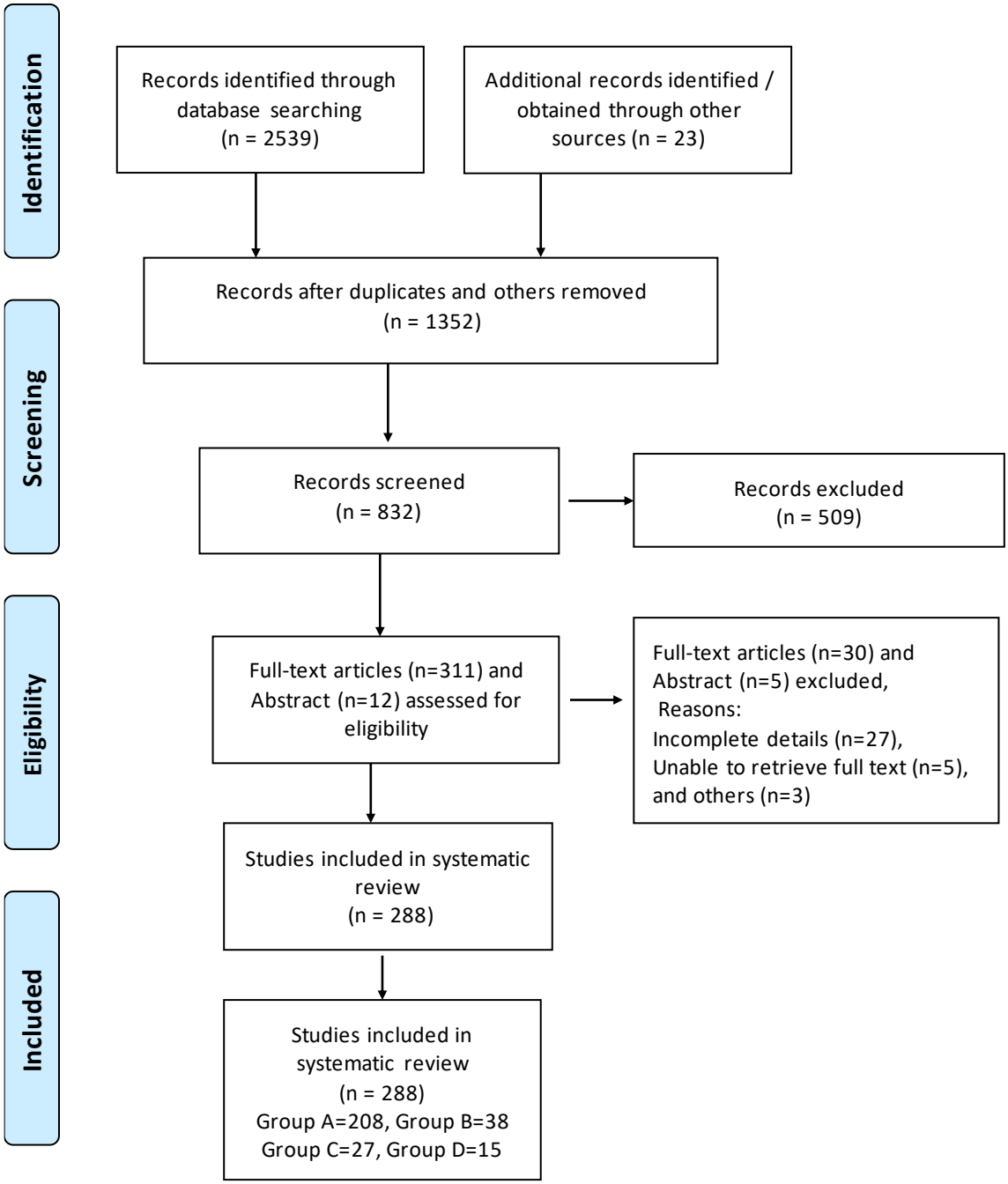


Figure 1: PRISMA flow diagram depicting the manuscripts selection process

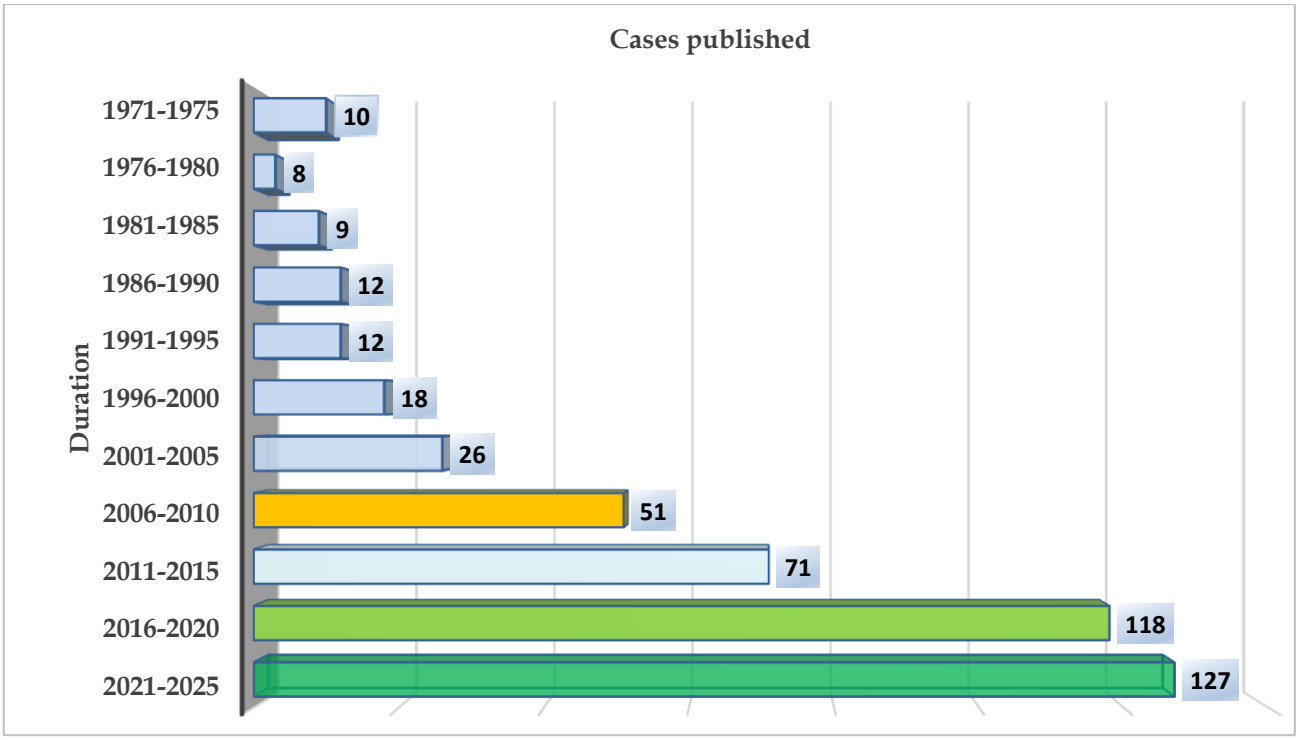


Figure 2: Cases published on VPS catheter extrusion through natural orifices, (n=457).

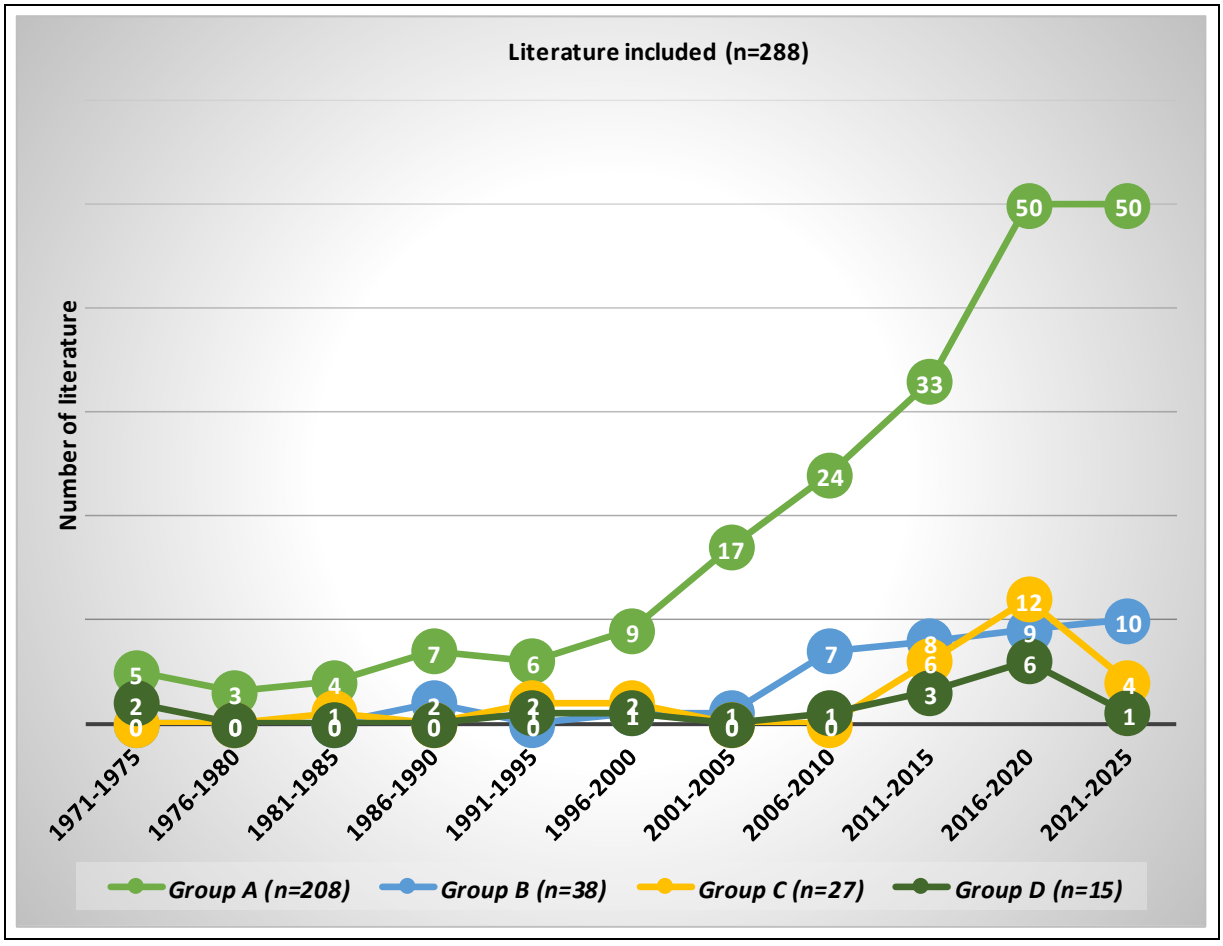


Figure 3: Yearly and group-wise details of the literature included in the review.

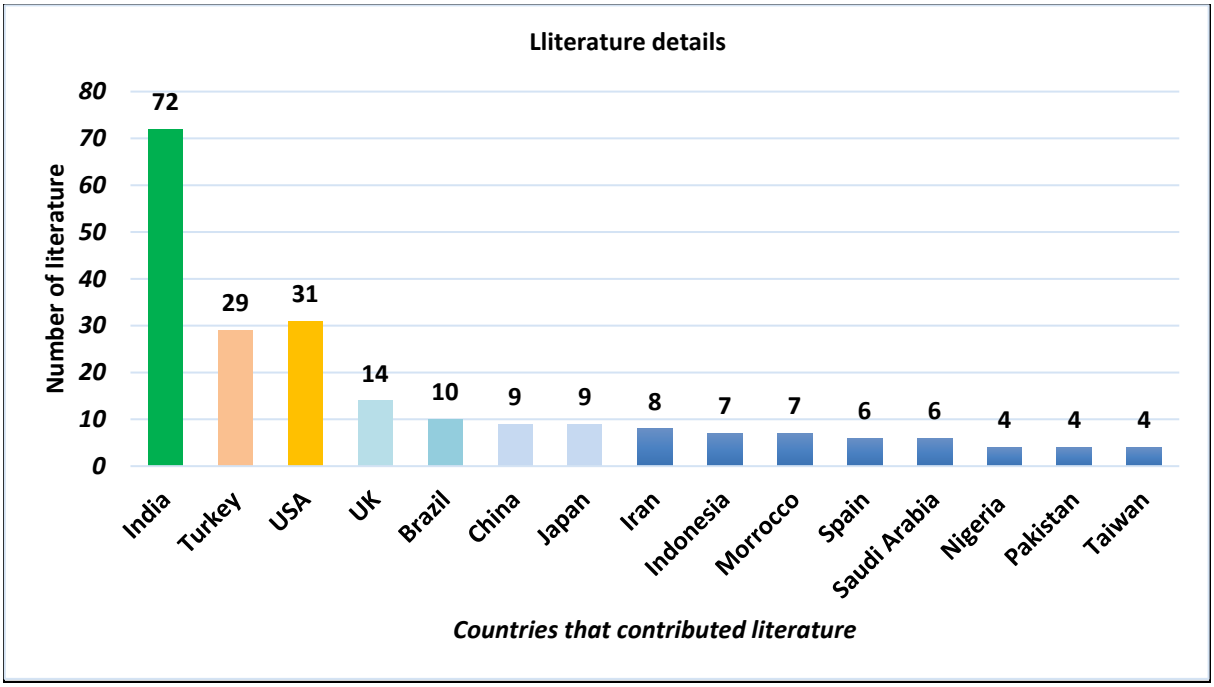


Figure 4: Countries that published at least four or more manuscripts during the study period.

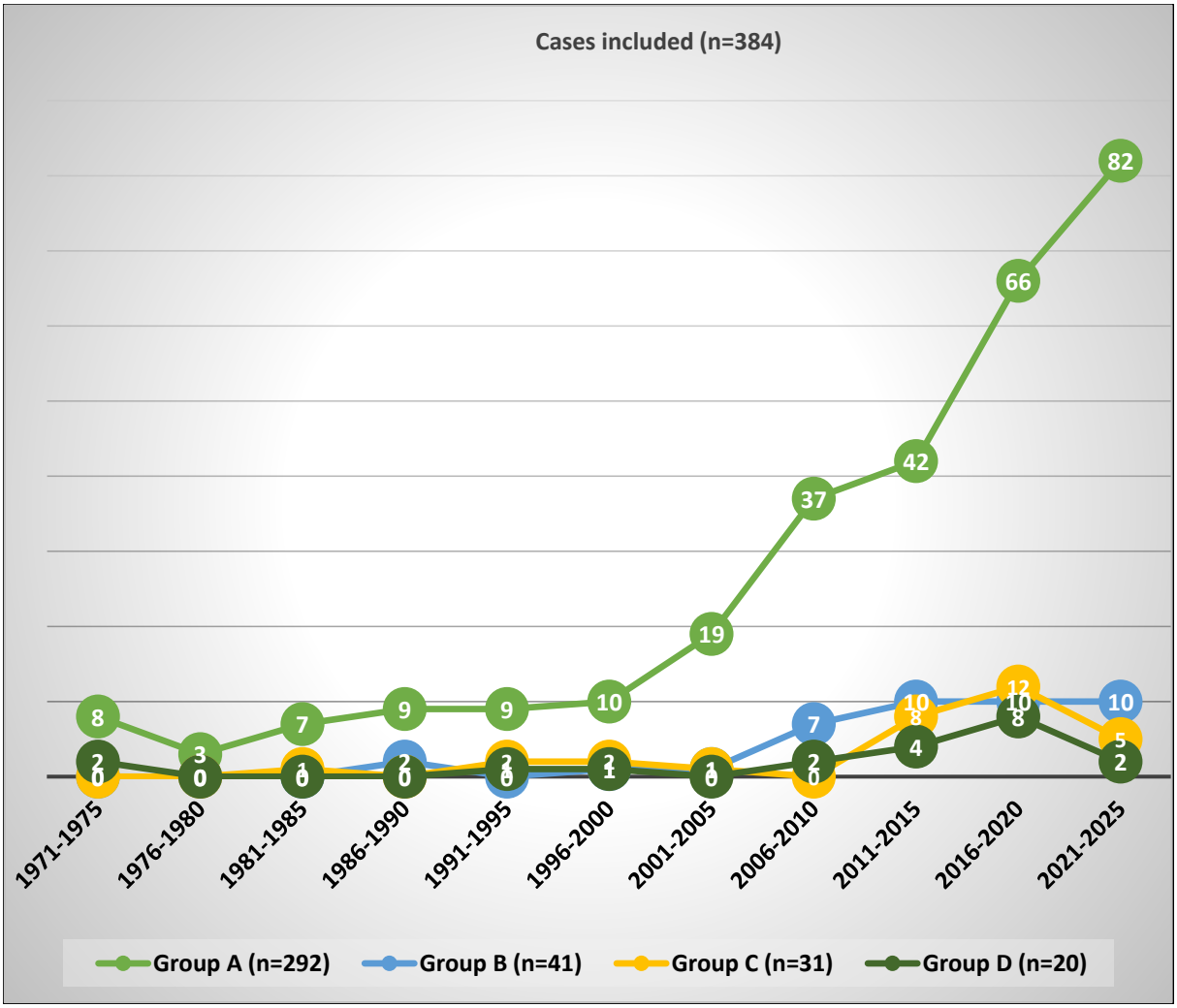


Figure 5: Group and year-wise published cases included in the review.

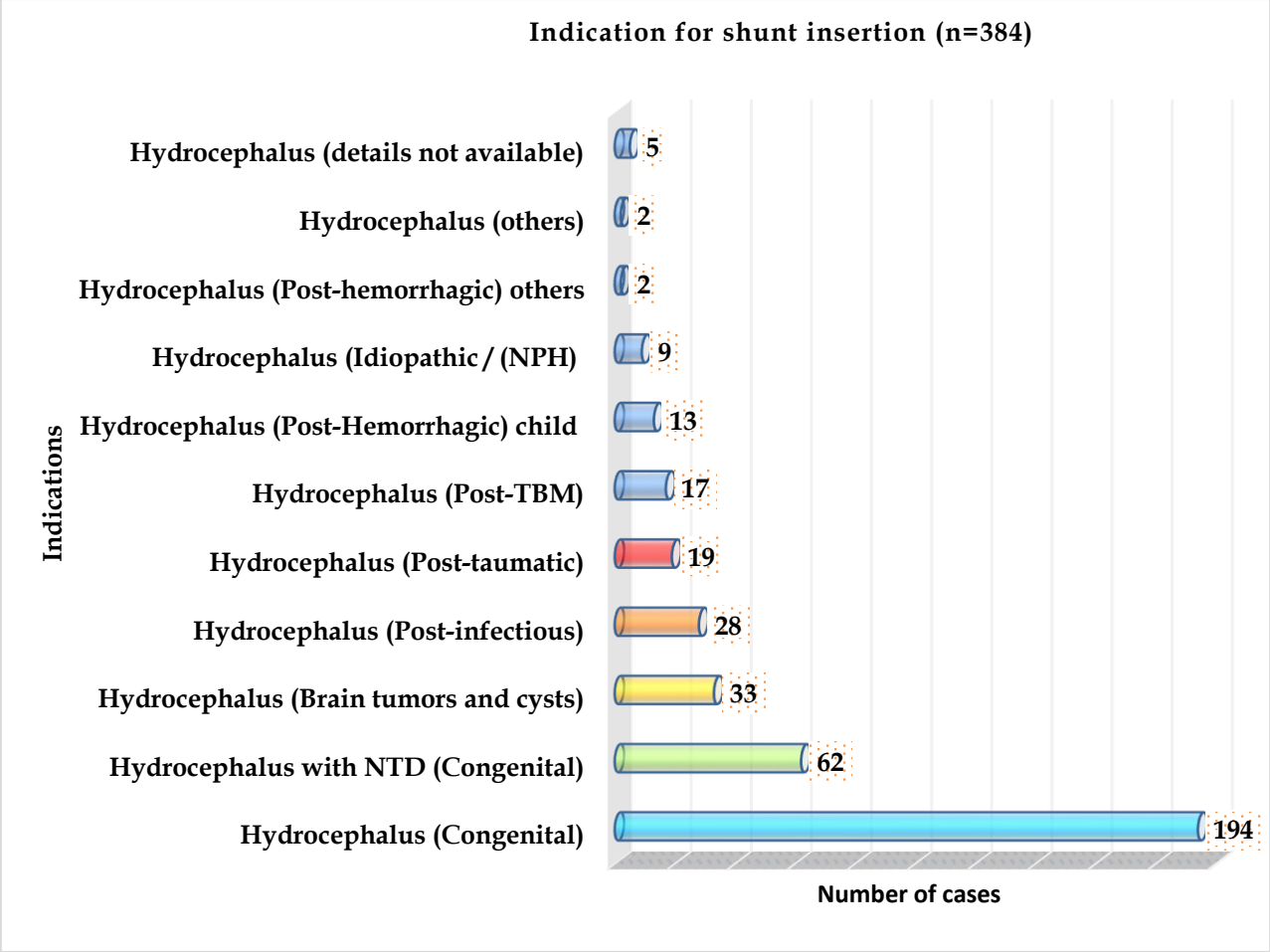


Figure 6: Indications for primary VPS catheter insertion.

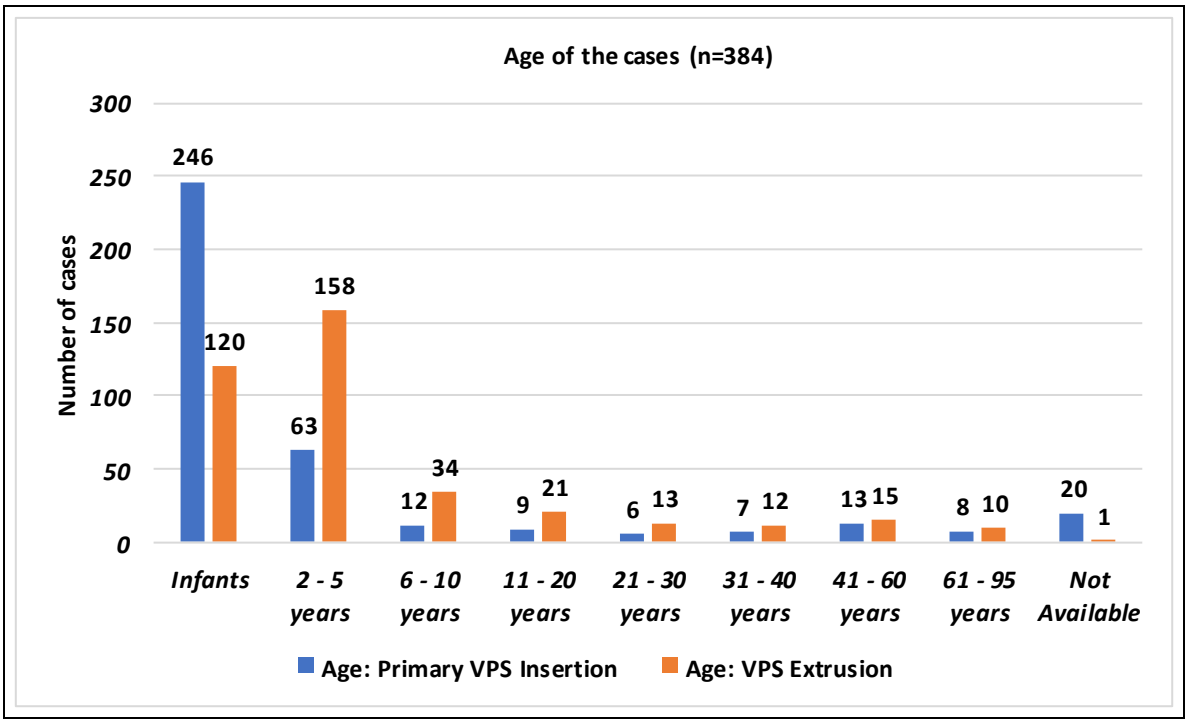


Figure 7: Ages of patients at the time of initial shunt insertion and diagnosis of VPS catheter extrusion.

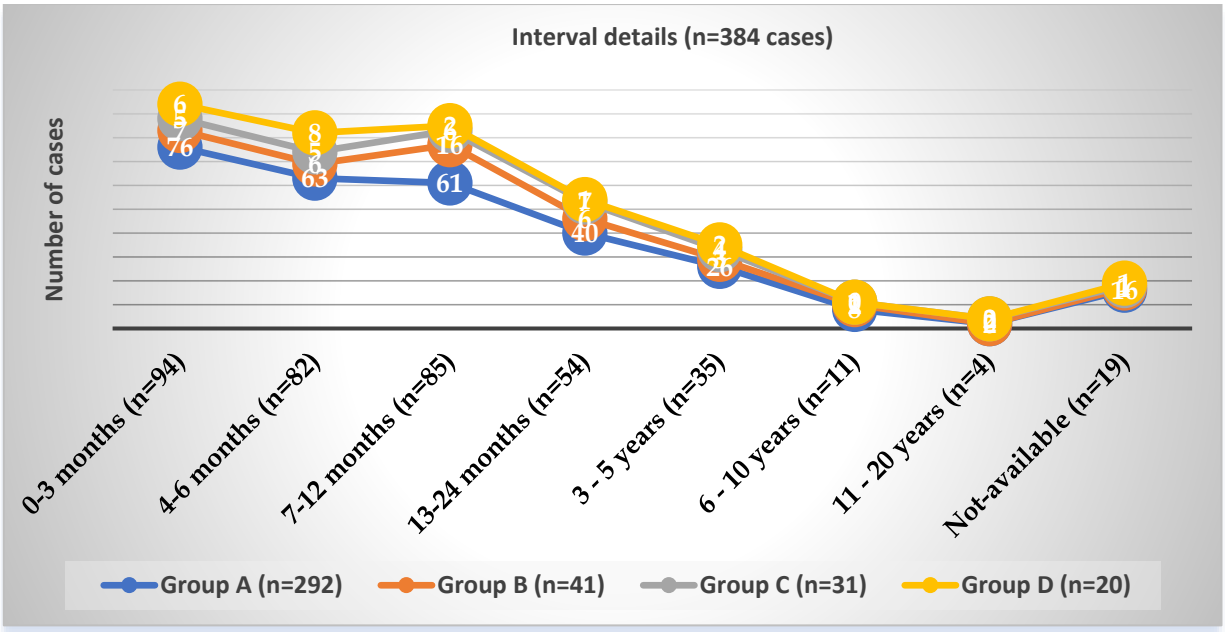


Figure 8: Group-wise presentation of the interval for included cases.

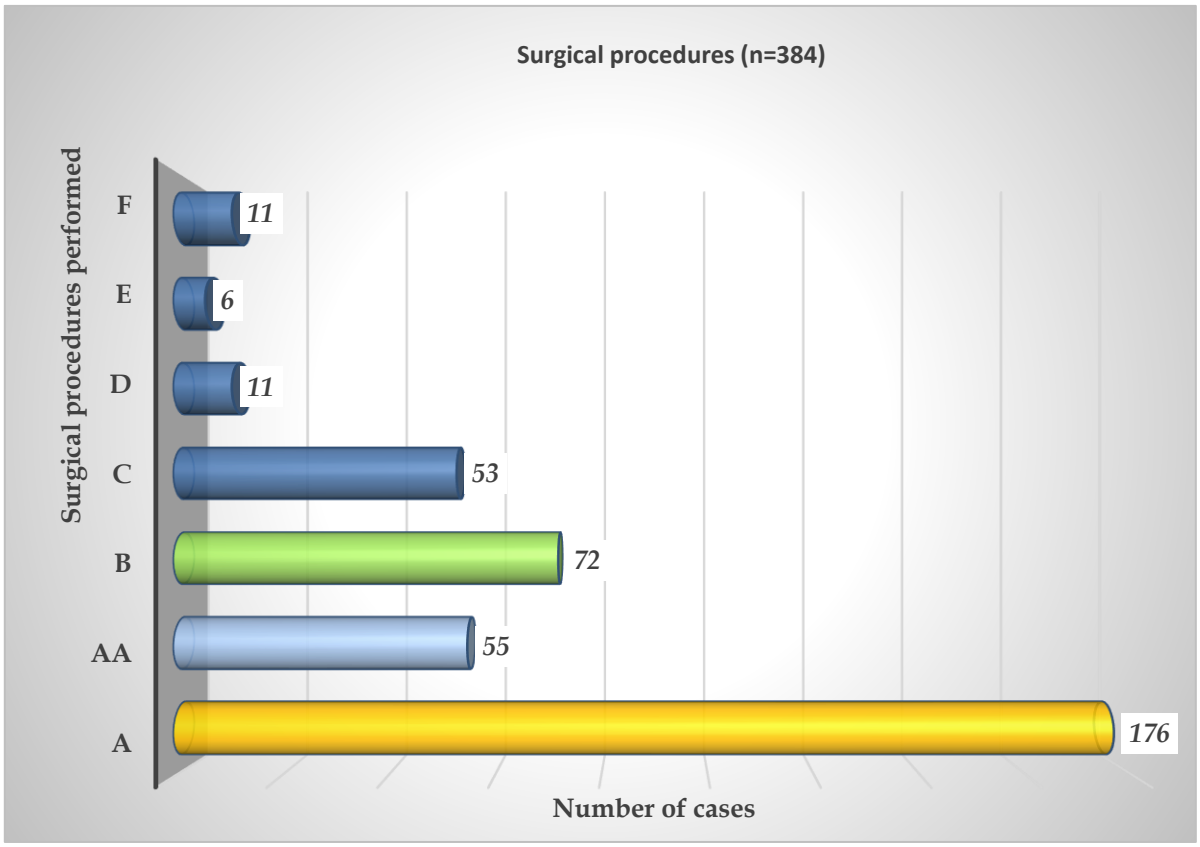


Figure 9: Surgical procedures performed for VPS catheter extrusion via natural orifices.

*A: Removal of entire ventriculo-peritoneal shunt catheter only without EVD, AA: Removal of entire ventriculo-peritoneal shunt catheter with EVD, B: Removal of distal ventriculo-peritoneal shunt catheter and proximal catheter as EVD, C: Removal of distal ventriculo-peritoneal shunt catheter and immediate relocation / revision of distal catheter, D: Removal of distal ventriculo-peritoneal shunt catheter with or without other procedure, E: Removal of ventricular/proximal ventriculo-peritoneal shunt catheter, F: Surgical procedure not required/ not done/ details not available.

Table 1: Demographics and other details of cases that died during postoperative period (n=16). (Extrusion of VPS catheters via natural orifices).

Author(s) publication year (Reference No.)	Indication for VPS insertion	Age (months)/ sex (VPS insertion)	Age (months) VPS extrusion	Interval (months)	Site of VPS extrusion	Operation procedures executed	Cause of death
Sells et al 1973[15]	Hydrocephalus (congenital) with NTD	5 / Female	36	4?	Trans-anal	(Per-rectal passage of peritoneal catheter twice, 8 months earlier), surgical drainage of subhepatic abscess, removal of entire VPS catheter for its obstruction, and ventriculostomy done	Peritonitis, abdominal abscesses, CSF infection
Pascual Castroviejo et al 1975[20]	Hydrocephalus (congenital)	Infant/ Male	13	8	Trans-anal	Removal of entire VPS catheter?	Meningitis
Griffith et al 1987[16]	Hydrocephalus (post-infectious)	9.6 years, Female	9.9 years	3	Trans-oral	Part of distal VPS catheter cut by child, proximal VPS catheter as EVD, delayed ventriculo-atrial shunt done	brain stem herniation/ malfunction VPS system
Pianetti Filho et al 1991[64]	Hydrocephalus (congenital) with NTD	2/ Female	8	3	Trans-vaginal	Removal of entire (right) VPS catheter, left-sided VPS system working well)	Meningitis, CSF infection
Caksen et al 2003[27]	Hydrocephalus (post-hemorrhagic)	3/ Male	10	7	Trans-anal	Removal of entire VPS catheter, re-VPS insertion done, removal of entire VPS catheter, repeated CSF drainage	Meningitis, malfunction VPS system
Vinchon et al 2006[29]	Hydrocephalus (congenital)	5/ Female	12	7	Trans-anal	Removal of entire VPS catheter, delayed re-VPS catheter insertion	CSF infection
de Aquino et al 2006[30]	Hydrocephalus (post-infectious)	17 years Male	18 years	12	Trans-anal	Removal of entire VPS catheter?	Ventriculitis, CSF infection
Berhouma et al 2008[49]	Hydrocephalus (congenital) with NTD	9/ Male	24	15	Trans-oral	Removal of part of distal VPS catheter, proximal VPS catheter as EVD	Ventriculitis, Sepsis
de Aguiar et al 2011[60]	Hydrocephalus (congenital) with NTD	Infant Female	12 years	NA	Trans-urethral	Removal of part of distal VPS catheter, proximal VPS catheter as EVD,	Renal failure
Ishii et al 2014[37]	Hydrocephalus (congenital)	11/ Female	25	14	Trans-anal	Removal of part of distal VPS catheter, proximal VPS catheter as EVD	Meningitis, sepsis
Santos et al 2021[43]	Hydrocephalus (congenital)	24/ Female	6 years	48	Trans-anal	Removal of entire VPS and EVD, revisions of EVD done	Sepsis and septic shock
Ghritlaharey 2022[44]	Hydrocephalus (TBM)	48/ Female	81	33	Trans-anal	Removal of part of distal VPS catheter, immediate revision of distal catheter	CSF leakage, medical illness
Ghritlaharey 2022[44]	Hydrocephalus (TBM)	18/ Male	83	49	Trans-anal	Removal of part of distal VPS catheter, proximal catheter converted as EVD, delayed re-VPS insertion done	Preexisting poor general condition
Ghritlaharey 2022[44]	Hydrocephalus (congenital), NTD with neurological deficits	5/ Male	28	23	Trans-anal	Removal of part of distal VPS catheter, immediate revision of distal catheter, removal of entire VPS for infection, delayed re-VPS insertion done	Respiratory failure (aspiration of food particles)
Ghritlaharey 2022[44]	Hydrocephalus (congenital)	5 / Male	8	3	Trans-anal	Removal of part of distal VPS catheter, immediate revision of distal catheter	Meningitis
Renée et al, 2025[47]	Hydrocephalus (congenital)	1 / Female	2.5	1.5	Trans-anal	Removal of entire VPS catheter, re-VPS insertion done	Meningitis

Table 2: Comparative summary of results from the literature review (Extrusion of VPS catheter through natural orifices).

Descriptions	Details	Trans-anal extrusion (%)	Trans-oral extrusion (%)	Trans-urethral extrusion (%)	Trans-vaginal extrusion (%)	Total (%)
Literature	From-to	1973 to 2025	1980 to 2025	1982 to 2025	1973 to 2025	-
	Included	208	38	27	15	288
	Excluded	27	4	3	1	35
Cases	Included	292 (76.04)	41 (10.67)	31 (8.07)	20 (5.20)	384 (100)
	Excluded	57	6	8	2	73
Sex distribution (Included cases)	Male	183 (62.67)	23 (56.09)	15 (48.38)	-	221 (57.55)
	Female	109 (37.32)	18 (43.90)	16 (51.61)	20 (100)	163 (42.44)
Sex ratio	Males to females	1.67:1	1.27:1	0.93:1	-	1.35:1
Indication (VPS insertion)	Hydrocephalus (Congenital)	149 (51.02)	20 (48.78)	14 (45.16)	11 (55)	194 (50.52)
	Hydrocephalus with NTD	51 (17.46)	6 (14.63)	1 (3.22)	4 (20)	62 (16.14)
Past history	VPS revision	62 (21.23)	9 (21.95)	9 (29.03)	7 (35)	87 (22.65)
VPS (primary) insertion done	Infancy	186 (63.69)	27 (65.85)	19 (61.29)	14 (70)	246 (64.06)
	13 to 60 months	51 (17.46)	5 (12.19)	5 (16.12)	2 (10)	63 (16.40)
Extrusion of VPS catheter	Infancy	94 (32.19)	12 (29.26)	5 (16.12)	9 (45)	120 (31.25)
	13 to 60 months	120 (41.09)	19 (46.34)	13 (41.93)	6 (30)	158 (41.14)
Interval	0-12 months	200 (68.49)	29 (70.73)	16 (51.61)	16 (80)	261 (67.96)
	13-24 months	40 (13.69)	6 (14.63)	7 (22.58)	1 (5)	54 (14.06)
Symptoms	VPS extrusion	266 (91.09)	41 (100)	27 (87.09)	18 (90)	352 (91.66)
Clinical finding	Extruded VPS catheter (yes)	256 (87.67)	38 (92.68)	29 (93.54)	20 (100)	343 (89.32)
Clinical findings	Meningitis (yes)	24 (8.21)	0	2 (6.45)	4 (20)	30 (7.81)
	Peritonitis (yes)	6 (2.05)	0	0	0	6 (1.56)
Radiological investigations	C T scan-Head	45 (15.41)	11 (26.82)	10 (32.25)	6 (30)	72 (18.75)
	C T scan-Abd	27 (9.24)	1 (2.43)	3 (7.31)	2 (10)	33 (8.59)
	C T scan-Both (Head and abd)	19 (6.5)	3 (7.31)	4 (9.75)	0	26 (6.77)
Surgical procedures	Removal of entire VPS±EVD	169 (57.87)	26 (63.41)	21 (67.74)	15 (75)	231 (60.15)
	Removal of distal VPS catheter and proximal as EVD	60 (20.54)	10 (24.39)	2 (6.45)	0	72 (18.75)
Surgical techniques	Percutaneous	150 (51.36)	29 (70.73)	16 (51.61)	15 (75)	210 (54.68)
	Laparotomy	96 (32.87)	9 (21.95)	9 (29.03)	2 (10)	116 (30.20)
	Laparoscopic	9 (3.08)	3 (7.31)	3 (9.67)	1 (5)	16 (4.16)
	Endoscopic	16 (5.47)	0	2 (6.45)	0	18 (4.68)
Perforation	Repaired (Yes)	76 (26.02)	10 (24.39)	10 (32.25)	2 (10)	98 (25.52)
	Repaired (No)	211 (72.26)	27 (65.85)	19 (61.29)	18 (90)	275 (71.61)
VPS revisions, (n=250)	Delayed re-VPS	107	13	7	11	138 (55.2)
	Delayed VPS (R)	15	3	1	0	19 (7.6)
	Immediate re-VPS insertion	14	4	3	0	21 (8.4)
Complications	Postoperative	24 (8.21)	5 (12.19)	5 (16.12)	1 (5)	35 (9.11)
Result	Recovered	271 (92.8)	38 (92.68)	29 (93.54)	18 (90)	356 (92.70)
	Details NA/other	9 (3.08)	1 (2.43)	1 (3.22)	1 (5)	12 (3.12)
	Mortality	12 (4.1)	2 (4.87)	1 (3.22)	1 (5)	16 (4.16)

DISCUSSION

VPS catheter implantation is one of the most commonly performed neurosurgical procedures to treat hydrocephalus.[3,76] Although shunt insertion is frequently performed and technically simple surgical procedure, it is associated with various complications.[5-7] Shunt infections and shunt obstructions are common complications and are also the causes for shunt malfunction.[5-7,77] Many shunt-related complications require shunt revisions.[5,6,78] In most cases, shunt-related complications occurred within 12 months of insertion, and shunt revisions are required within 12 months of its insertion in most cases as well.[78] Migration of VPS catheters inside and through various body parts, including the hollow viscera such as stomach, small intestine and large intestine, urinary bladder, and uterus, has been reported.[8-13] This review manuscript is one of the unique and, to the author's best knowledge, probably the first of its kind review of world literature, incorporating all the cases of the extrusion of distal VPS catheters through natural orifices, since its first report.

Summary of evidence

In 1966, Wilson and Bertan first reported two cases of bowel perforation resulting with passage of peritoneal catheters through the anal canal, a complication of peritoneal shunts used to treat hydrocephalus.[11] In both cases, both infants, lumber-peritoneal shunts, rather than ventriculo-peritoneal shunt systems, were implanted to treat hydrocephalus. Both the above-mentioned cases were excluded from the review. In 1973, Sells et al described the first instance of trans-anal extrusion and passage of a VPS catheter occurring twice within four months in a 3-year-old girl.[15] Manuscripts relevant to trans-anal extrusion of VPS catheters were retrieved from 1973 to December 31, 2025. In 1987, Griffith et al reported the first case of gastric perforation, followed by trans-oral extrusion of the end of a VPS catheter.[16] Manuscripts on trans-oral extrusion of VPS catheters were retrieved from 1987 to December 31, 2025. In 1982, Burnette Jr. reported the maidan case of trans-urethral extrusion of the distal end of a VPS catheter.[17] Manuscripts regarding trans-urethral extrusion of VPS catheters were retrieved from 1982 to December 31, 2025. In 1973, Patel et al reported the first case of extrusion of a VPS catheter through the vaginal orifice.[18] Manuscripts documenting trans-vaginal extrusion of distal VPS catheters were retrieved from 1973 to December 31, 2025.

A comprehensive electronic database search identified n=457 cases of VPS catheters extrusion through various natural orifices between 1973 and December 31, 2025. Of these, four-fifths (n=367) cases were published in the last 20 years (January 2006 to December 2025). More than two-thirds (n=316; 69.14%) cases were published in the past 15 years (January 2011 to December 31, 2025), while fifty-four percent (n=245) cases were reported/published in the last 10 years between January 2016 to December 2025. A total of n=288 articles qualified/recruited for the present literature review, while n=35 articles were excluded from review for various reasons. Further review of the included manuscripts identified that n=261 (90.62%) were published and available in English, and n=27 (9.37%) of manuscripts published and available in a language other than English. The manuscripts available in other languages were translated into English using "Google Translate," and the desired indices were extracted. Most of the manuscripts included for review (n=280; 97.22%) were full texts, while only n=8 were abstracts.

Thirty-five manuscripts were excluded from the current review, comprising n=73 cases of VPS catheter extrusion through natural orifices.[69-75] The reasons for exclusion were; incomplete case details n=64, full-text non-retrieved n=5, non-English literature n=1, and other causes n=3.[69-75] Of these excluded cases, approximately four-fifth (n=57) of the cases were diagnosed with trans-anal extrusion of the VPS catheter; fifty-two cases excluded for incomplete case details, and 5 were excluded for unable to retrieve the full texts for the cases.[71-75] Eight of the excluded cases exhibited trans-urethral extrusion; n=7 cases excluded for incomplete case details, and one for non-English literature.[69,73] Six of the excluded cases exhibited trans-oral extrusion; four of them excluded for incomplete case details, and 2 for other causes.[73] Two of the excluded cases were diagnosed as trans-vaginal extrusion and was excluded for incomplete case details.[70]

Three-fourths (n=220) of the included manuscripts were published as case reports. Nineteen were published under the heading of Letter to Editor. Twelve manuscripts were published as case series, another n=12 were published under the heading of original articles, and n=10 were published as Images. Seven of the articles were published as correspondence, n=6 as review articles, and n=2 of the manuscripts was published under the heading of the surgical technique. This review also included n=7 cases of the trans-anal extrusion of the distal end of the dural-peritoneal shunt and n=4 cases of cysto-peritoneal shunt.[17,31,33,40]

Globally, the exact number of VPS catheter implantations performed remains uncertain due to the lack of a comprehensive registry. In the United States, more than 30,000 shunt procedures are performed annually.[5,78] Estimates suggest that hundreds of thousands of VPS catheters are implanted worldwide each year for the management of hydrocephalus, not only for initial procedures, but for shunt revision as well. In relation to the above, only n=457 cases of shunt catheter extrusion through natural orifices have been reported to date, which is much less. Among the 288-literature included in this global literature review, half (146) of manuscripts were contributed/published from India (72), Turkey (29), the United States (31), and the United Kingdom (14). An

additional quarter (n=74) of literature/manuscripts were contributed by eleven countries: Brazil (10), China (9), Japan (9), Iran (8), Indonesia (7), Morocco (7), Spain (6), Saudi Arabia (6), Nigeria (4), Pakistan (4), and Taiwan (4). The following countries contributed three manuscripts each: including Bangladesh, Egypt, Ethiopia, Greece, Italy, Korea, Malaysia, and Mexico. Eleven countries contributed two manuscripts each: Australia, Algeria, Argentina, Cameroon, Colombia, Germany, Israel, Oman, Palestine, South Africa, and Tunisia. The following countries contributed only one manuscript on the management of VPS catheter extrusion through natural orifices during the study period: Afghanistan, Bosnia and Herzegovina, Bulgaria, Canda, Cuba, France, Gana, Iraq, Ivory Coast, Kwala Lumpur, Libia, Madagascar, New Zeeland, Poland, Philippines, Rome, Singapore, Somalia, Scotland, Syria, Serbia, and the United Arab Emirates.

This review of global literature on the management of distal VPS catheter extrusion through natural orifices included n=384 cases. Of these, three-fourths (n=292) cases involved extrusion of the distal VPS catheters through the anal canal.[8,9,15,19-47] The trans-oral extrusion of distal VPS catheter comprised of n=41; 10.67% cases.[16,48-57] Trans-urethral extrusion of distal VPS catheter comprised of n=31; 8.07% cases.[17,58-63] The trans-vaginal extrusion of distal VPS catheter consisted of n=20; 5.2% cases.[18,64-68]

In two-thirds of cases (n=256), the primary indication for initial VPS catheter insertion was hydrocephalus resulting from congenital pathologies. Of these, 62; 16.14% cases also presented with associated neural tube defects (NTD). Hydrocephalus due to brain tumors and cysts accounted for shunting in n=33; 8.59% cases. In n=28; 7.29% cases, VPS catheters were implanted for post-infectious hydrocephalus. Post-traumatic hydrocephalus required VPS catheter implantation in n=19 (4.94%), while hydrocephalus secondary to TBM accounted for n=17 (4.42%) cases. Additionally, n=13; 3.38% children underwent VPS catheter implantation for hydrocephalus secondary to haemorrhage.

Four-fifths (n=309) of the VPS catheters were initially implanted in children aged infancy to 5 years. The initial VPS catheters were implanted during infancy in n=246; 64.06% of the cases. On 26; 6.77% occasions, the VPS catheter was implanted in individuals aged 21 years to 60 years. Four-fifths (n=312) of VPS catheter extrusion through natural orifices occurred in children under 10 years of age. Of the total included cases, n=278 (72.39%) were infants, and children aged 2-5 years of age at diagnosis who received treatment for catheter extrusion through various natural orifices. In 31% (n=120) of cases, this VPS complication was identified during infancy. VPS catheter extrusion through natural orifices was rarely reported in individuals aged 61 to 95 years and onwards, with only 10 cases documented in this age group. Analysis of the present data showed that in two-thirds of cases (n=261; 67.96%), extrusion of distal VPS catheters through natural orifices occurred within 12 months of the initial VPS insertion or the most recent shunt revision. In n=54 cases (14.06%), this event took place between 13 and 24 months. Extrusions of VPS catheters through natural orifices more than five years after implantation or revision was rare, with only n=15 cases diagnosed after 5 years.

In most cases (n=372; 96.87%), the chief complaint was extrusion of the distal VPS catheter through various natural orifices. Some cases also presented with additional symptoms involving the central nervous system (n=47; 12.23%), gastrointestinal tract (n=36; 9.37%), urogenital tract (n=8; 2.08%), or other general symptoms. On clinical examination, extruded distal VPS catheters were detected in n=343; 89.32% cases. In n=26; 6.77% cases, the end of the catheters had retracted back inside the hollow viscera. In n=11; 2.86% cases, the distal part of the shunt catheters had already passed through the natural orifices and was not found on clinical examination. In three cases, the extruded catheter segment had been cut by the parents or patient and was not found during examination, while in one case, it was not detected due to another cause. Clinical signs suggestive of meningitis were detected in n=30 cases, representing 7.81% of the included cases.[18,19,21,23-26,28,30,33,34,36,42,46,64,67] The majority (n=24) of the cases that had signs of meningitis involved trans-anal extrusion of the VPS catheter. Signs of peritonitis were observed in n=6; 1.56% cases, all of which also involved trans-anal extrusion of the shunt catheter.[19,46]

In most cases (n=343), the clinical diagnosis was apparent due to the presence of extruded shunt catheters through various natural orifices observed during clinical examination. Plain skiagrams of the relevant body parts, depending on the site of extrusion of shunt catheters, were the most frequently performed imaging studies. Cranial computed tomography (CT) scans were ordered for 72; 18.75% cases: Group A=45 cases, group B=11 cases, group C=10 cases, and group D=6 of the cases.[8,9,19,22,24,25,27,29,34,36,40-43,45,49,51,59,60,63] Abdominal CT scans were obtained in n=33 (8.59%) of the cases: Group A=27 cases, group B=1 case, group C=3, and group D=2 cases of the entire cases.[8,9,19,22,25,29,34,42,45] In addition to the above investigations, both cranial and abdominal CT scans were obtained in another n=26; 6.77% of the cases: Group A =19 cases, group B=3 cases, and group C=4 cases.

Management objectives for VPS catheter extrusion through natural orifices include: (a) removal of extruded shunt catheters; (b) assessment for repair of perforated viscera; (c) treatment of associated clinical findings particularly meningitis, peritonitis, or CSF infection (growth of organism on CSF culture); and (d) evaluation and selection of cases for shunt revision when indicated. The selection of surgical procedure is guided by the presence or absence of meningitis or peritonitis. In most

cases (n=303; 78.90%), the preferred approach was removal of the entire or part of the distal VPS catheter, with or without insertion of an EVD. Removal of the entire VPS catheter without EVD was performed in n=176 cases (45.83%). In 55 cases (14.32%), the entire VPS catheter was removed and an EVD was also placed. In n=72 cases (18.75%), the distal/peritoneal portion of the VPS catheter was removed, and the proximal or ventricular part was converted to an EVD. Other surgical interventions that were performed, in order of frequency, included removal of part of the distal shunt catheter with immediate relocation of the remaining peritoneal catheter within the peritoneal cavity or revision of the peritoneal/distal catheter (n=53; 13.80%), removal of the distal shunt catheter with or without other additional procedures (n=11; 2.86% cases), and removal of the ventricular or proximal shunt catheter (n=6 cases). In n=11 cases, surgical intervention was either not required, not performed, or operative details were unavailable. CSF obtained during the management of the above-mentioned cases was submitted for culture; in n=40 cases, cultures were positive for organisms, but none of these n=40 patients exhibited clinical features of meningitis at presentation.

Surgical techniques selected by various authors for managing cases of extrusion of VPS catheters through the various natural orifices were as follows: percutaneous or subcutaneous route n=210; 54.68%; laparotomy n=116; 30.20%; endoscopic procedures n=18; 4.68%; and laparoscopic procedures n=16; 4.16%. Surgical procedure was not required in n=8 cases, surgical procedure not done in n=3, and details for the surgical procedures were not available for another n=7 of the cases. Perforations of hollow viscera (stomach, small and large bowel, urinary bladder, or uterus) caused by distal VPS catheters were repaired only in one-fourth (n=98) of the cases. Perforations of hollow viscera by VPS catheters were neither repaired nor required repair in n=275 (71.61%) of the included cases. For n=11 of the cases, details were not available on whether the perforation was repaired or not.

During the management of the above-described cases, shunt revisions were also required. Analysis of the included cases identified n=250 instances necessitating revision procedures. Delayed re-VPS catheter implantation was performed in n=138, 55.2% cases. Immediate revision of the distal/peritoneal segment of the VPS catheter was done in n=38; 15.2%, while immediate re-VPS catheter insertion was performed in n=21; 8.4% cases. Delayed conversion to a ventriculo-atrial or ventriculo-pleural shunt was performed in n=23, 9.2% cases, and delayed revision of distal VPS catheter done in n=19; 7.6% cases. In eight of the cases, endoscopic third ventriculostomy and immediate conversion to a ventriculo-atrial or another shunt was performed in n=3 of the cases. Additionally, literature review revealed that in n=61 cases, neither shunt revisions nor re-VPS insertion was required during the immediate postoperative period or in follow-up period. For another n=57 cases, the details regarding whether revision procedures were performed or not, were not specified.

Various complications were also observed in n=35 (9.11%) of cases after surgical procedures performed for VPS catheter extrusion through natural orifices. Twenty-four of the cases that were surgically treated for trans-anal extrusions of VPS catheters observed various complications during the postoperative period.[15,20,27,29,30,32,37,40,43,44,47] Complications were also observed in n=5 cases who were treated for trans-oral extrusion of VPS catheter.[16,49,56] Complications were observed in n=5 cases who were managed for trans-urethral extrusion and in one case who was treated for trans-vaginal extrusion of VPS catheter.[59,60,62,64] These complications were meningitis (n=11), intra-abdominal abscess (n=3), CSF leak from abdominal wound site (n=3), pleural effusion (n=3), intestinal obstruction (n=2), brain abscesses (n=2), CSF pseudocyst of abdomen (n=2), peritonitis (n=1), VPS malfunction (n=1), sepsis/septicemia (n=1), extrusion of shunt catheter through healed abdominal wound (n=1), fecal discharge through abdominal wound (n=1), respiratory failure (n=1), brain stem herniation/shunt malfunction (n=1), and tubular acidosis/electrolyte imbalance (n=1).

The outcome of surgical procedures performed by various authors to manage extrusion of distal VPS catheters through various natural orifices were mostly reported as good. Mortality following VPS insertions and revisions done for hydrocephalus has also been reported in the literature.[77,79,80] The present review documented n=16; 4.16% deaths.[15,16,20,27,29,30,37,43,44,47,49,60,64] Twelve cases died who were treated for trans-anal extrusion of the VPS catheter.[15,20,27,29,30,37,43,44,47] Two cases that died had trans-oral extrusion of the shunt catheter.[16,49] One case who died had trans-urethral extrusion, and n=1 case who died had trans-vaginal extrusion of shunt catheter.[60,64] Ten of the cases who died were children below 36 months of age when they were clinically presented and treated for extrusion of the distal VPS catheters.[15,20,27,29,37,44,47,49,64] Another n=5 cases who died were also children, and their ages ranged from 6 to 12 years.[16,43,44,60] One case who died was an 18-year-old male, who was treated for extrusion of a distal VPS catheter through the anal canal, and he died of ventriculitis.[30] The causes of death among n=16 cases were meningitis/ventriculitis n=8, sepsis n=2, peritonitis n=1, brain stem herniation/shunt malfunction n=1, respiratory failure due to aspiration of food particles n=1, preexisting poor general condition n=1, medical illness n=1, and electrolyte imbalance caused by renal tubular acidosis n=1.

Limitations

The main limitation of this review is the exclusion of 35 manuscripts, representing n=73 cases of VPS catheter extrusion through natural orifices, for various reasons. Of these, n=57 (four-fifths) of excluded cases was diagnosed

with trans-anal extrusion of the VPS catheter. Eight of the excluded cases exhibited trans-urethral extrusion, six had trans-oral extrusion, and two involved trans-vaginal extrusion of the VPS catheter. Another limitation is that not all included and excluded studies are cited in the reference list. Additionally, the review identified a lack of uniformity or standardized surgical techniques for managing cases diagnosed with VPS catheter extrusion through natural orifices. Finally, this review was not registered with any systematic review registry.

CONCLUSION

VPS catheter extrusion through various natural orifices was observed in patients of all ages, with trans-anal extrusion occurring most frequently. In two-thirds of cases, hydrocephalus due to congenital pathologies was the primary indication for VPS catheter implantation. Four-fifths of VPS catheters were initially implanted during infancy or in children up to 5 years old. At presentation of catheter extrusion, 72% of patients were ≤5 years old. Catheter extrusion was reported within 12 months of VPS insertion or shunt revision in two-thirds of cases. Three-fourths of cases were managed by complete removal of the shunt system or distal catheter, with or without external ventricular drainage. Surgical repair of perforated hollow viscera-including the stomach, small or large bowel, urinary bladder, or uterus-was performed in only one-fourth of cases; in the remainder, perforations healed spontaneously without surgical closure. The percutaneous or subcutaneous approach was utilized in 54% of cases, while laparotomies were performed in 30% cases. Laparoscopic and endoscopic procedures were not frequently offered for managing such cases. For shunt revision, delayed reimplantation of the VPS catheter was preferred over other procedures. Patients with a VPS catheter who present with symptoms and signs of meningitis or CSF infection should be evaluated for possible visceral perforation, especially to exclude bowel perforation by the distal shunt catheter.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Hochstetler A, Raskin J, Blazer-Yost BL. Hydrocephalus: historical analysis and considerations for treatment. Eur J Med Res. 2022;27(1):168.
2. Dewan MC, Rattani A, Mekary R, Glancz LJ, Yunusa I, Baticulon RE, et al. Global hydrocephalus epidemiology and incidence: systematic review and meta-analysis. J Neurosurg. 2018;130(4):1065-79.
3. Greuter L, Ruf L, Guzman R, Soleman J. Open versus laparoscopic ventriculoperitoneal shunt placement in children: a systematic review and meta-analysis. Childs Nerv Syst. 2023;39(7):1895-902.
4. Pande A, Lamba N, Mammi M, Gebrehiwet P, Trenary A, Doucette J, et al. Endoscopic third ventriculostomy versus ventriculoperitoneal shunt in pediatric and adult population: a systematic review and meta-analysis. Neurosurg Rev. 2021;44(3):1227-41.
5. Paff M, Alexandru-abrams D, Muhonen M, Loudon W. Ventriculoperitoneal shunt complications: A review. Interdisciplinary Neurosurg. 2018;13:66-70.
6. Lazarus JS, Ohonba E, Li YJ, Rohlwink UK, Figaji AA, Enslin JMN. Ventriculoperitoneal shunt failures at Red Cross War Memorial Children's Hospital. Childs Nerv Syst. 2024;40(9):2871-81.
7. Kovács J, Máté V, Obeidat M, Nagy R, Agócs G, Kiss-Dala S, et al. Antibiotic-impregnated ventriculoperitoneal shunts decrease bacterial shunt infection: A systematic review and meta-analysis. Neurosurgery. 2024;95(6):1263-73.
8. Pant N, Singh S, Singh G, Kumar A, Rai RK, Rawat J, et al. The wandering ventriculoperitoneal shunt and the scope of its salvage. Childs Nerv Syst. 2021;37(8):2613-8.
9. Ezzat AAM, Soliman MAR, Hasanain AA, Thabit MA, Elshitany H, Kandel H, et al. Migration of the distal catheter of ventriculoperitoneal shunts in pediatric age group: Case series. World Neurosurg. 2018;119:e131-7.
10. Ghritlaharey RK. Migration of the distal ventriculoperitoneal shunt catheter into the stomach with or without trans-oral extrusion: A systematic literature review and meta-analysis. World J Clin Pediatr. 2023;12(5):331-49.
11. Ghritlaharey RK. Systematic literature review of the management of transanal extrusion of distal ventriculoperitoneal shunt catheter: 1966-2020. Med J DY Patil Vidyapeeth. 2022;15(5):629-59.
12. Ghritlaharey RK. Systematic review of migration of distal ventriculoperitoneal shunt catheter into the urinary bladder with or without per-urethral extrusion. Med J DY Patil Vidyapeeth. 2022;15(6):840-53.
13. Ghritlaharey RK. Management of trans-vaginal extrusion of the distal ventriculoperitoneal shunt catheter: a systematic literature review from 1973 to 2021. Int J Res Med Sci. 2021;9(11):3416-23.
14. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ. 2021;372:n71.
15. Sells CJ, Loeser JD. Peritonitis following perforation of the bowel: a rare complication of a ventriculoperitoneal shunt. J Pediatr. 1973;83(5):823-24.
16. Griffith JA, DeFeo D. Peroral extrusion of a ventriculoperitoneal shunt catheter. Neurosurgery. 1987;21(2):259-61.
17. Burnette DG Jr. Bladder perforation and urethral catheter extrusion: an unusual complication of cerebrospinal fluid-peritoneal shunting. J Urol. 1982;127(3):543-4.

18. Patel CD, Matloub H. Vaginal perforation as a complication of ventriculoperitoneal shunt. Case report. J Neurosurg. 1973;38(6):761-2.
19. Schulhof LA, Worth RM, Kalsbeck JE. Bowel perforation due to peritoneal shunt. A report of seven cases and a review of the literature. Surg Neurol. 1975;3(5):265-9.
20. Pascual Castroviejo I, Mulas F, Casas C, Martínez Bermejo A, Otero B. Anal extrusion: a complication of ventriculo-peritoneal shunt for hydrocephalus (author's transl). An Esp Pediatr. 1975;8(6):685-8.
21. Yamasaki S, Osaka K, Hirayama A, Asada M. Intra-abdominal complications following ventriculoperitoneal shunt. J Jap Soc Pediatr Surg. 1976;12(5):619-24.
22. Prabhu S, Cochran W, Azmy AF. Wandering distal ends of ventriculo-peritoneal shunts. Z Kinderchir. 1985; 40(2): 80-1.
23. Takahashi J, Makita Y, Nabeshima S, Tei T, Keyaki A, Miyamoto Y. Spontaneous extrusion of peritoneal tubes after ventriculoperitoneal shunting. Report of two cases. Neurol Med Chir (Tokyo). 1988;28(8):808-11.
24. Gupta VK, Sharma BS, Gupta SK, Kak VK. Extrusion of ventriculoperitoneal shunt per anum. Neurol India. 1995;43(3):175-6.
25. Sami A, Ait Ben Ali S, Choukry M, Achouri M, Naja A, Ouboukhlik A, et al. Anal migration of ventriculoperitoneal shunt catheter. Apropos of 3 cases. Neurochirurgie. 1995;41(4):315-8.
26. Digray NC, Thappa DR, Arora M, Mengi Y, Goswamy HL. Silent bowel perforation and transanal prolapse of a ventriculoperitoneal shunt. Pediatr Surg Int. 2000;16(1-2):94-5.
27. Caksen H, Kiymaz N, Odabaş D, Tuncer O, Ataş B. Anal protrusion of ventriculo-peritoneal shunt catheter in an infant. Brain Dev. 2003;25(2):146-7.
28. Ansari S, Nejat F, Dadmehr M. Extrusion of ventriculoperitoneal shunt catheter through the rectum and retrograde meningitis. Pediatr Infect Dis J. 2005;24(11):1027.
29. Vinchon M, Baroncini M, Laurent T, Patrick D. Bowel perforation caused by peritoneal shunt catheters: diagnosis and treatment. Neurosurgery. 2006;58(1):ONS76-82.
30. de Aquino HB, Carelli EF, Borges Neto AG, Pereira CU. Nonfunctional abdominal complications of the distal catheter on the treatment of hydrocephalus: an inflammatory hypothesis? Experience with six cases. Childs Nerv Syst. 2006;22(10):1225-30.
31. Baeza-Herrera C, Atzín-Fuentes JL, Velasco-Soria L, García-Cabello LM, Godoy-Esquivel AH. Spontaneous disconnection and expulsion per rectum of a subarachnoid-peritoneal shunt catheter. Bol Med Hosp Infant Mex. 2007;64(2):107-11.
32. Ghritlaharey RK, Budhwani KS, Shrivastava DK, Gupta G, Kushwaha AS, Chanchlani R, et al. Trans-anal protrusion of ventriculo-peritoneal shunt catheter with silent bowel perforation: report of ten cases in children. Pediatr Surg Int. 2007;23(6):575-80.
33. Urfalı B, Akçora B, Akdemir G, Çavuş G, Eriş Ö, Serarslan Y. An arachnoidal cystoperitoneal shunt catheter which protruded via anus and caused subdural empyema after colonic perforation: A rare complication. J Clin Pract Res. 2009;31(4):364-8.
34. Seyithanoğlu MH, Doğan K, Gündağ M, Kitiş S. Late complication of ventriculoperitoneal shunt: Protrusion of peritoneal catheter through the anus in four cases. Turk Neurosurg J. 2011;21(3):269-73.
35. Kundal VK, Gajdhar M, Sharma C, Agrawal D, Kundal R. Wandering distal end of ventriculo-peritoneal shunt: Our experience with five cases and review of literature. J Nepal Paedtr Soc. 2013;32(3):266-9.
36. Teegala R, Kota LP. Unusual complications of ventriculo peritoneal shunt surgery. J Neurosci Rural Pract. 2012;3(3):361-4.
37. Ishii T, Morita K, Tsugawa J, Sato S. A case of sigmoid colon perforation with ventriculoperitoneal shunt tube. J Jap Soc Pediatr Surg. 2014;50(2):230-4.
38. Dheer Y, Pandey A, Archika, Kureel SN. Transanal prolapse of ventriculo-peritoneal shunt in patients of lumbosacral meningomyelocele with hydrocephalous-A case series. Int J Adv Case Rep. 2015;2(23):1363-5.
39. Al Hinai Q, Salhotra N, Al Zabin M, Ali A, Al Abri S, Hashim M, et al. Series of 3 cases of silent colonic perforation by ventriculoperitonal shunt catheter prolapsing through anus, an infrequent complication: A case report. Am J Med Case Rep. 2017;5(3):59-61.
40. Chung BSR, Lee HJ. Delayed brain abscess after bowel perforation by a subdural-peritoneal shunt. J Radiol Med Imaging. 2018;1:1003.
41. Chugh A, Gotecha S, Amle G, Patil A, Punia P, Kotecha M. Abnormal migration and extrusion of abdominal end of ventriculoperitoneal shunt: An experience of eight cases. J Pediatr Neurosci. 2018;13(3):317-21.
42. Sinha VD, Bhardwaj S, Purohit D, Chopra S. Unusual extrusion of distal end of ventriculoperitoneal shunt: Case series with literature review. Interdisciplinary Neurosurg. 2021;24:101026.
43. Santos RC, Monteiro K de KO, Moura VV, Anchieta RA, Caixeta LN, Strapasson ACP. Anal extrusion of ventriculoperitoneal shunt catheter-report of 2 cases and review of management. COORTE-Revista Científica do Hospital Santa Rosa. 2021.
44. Ghritlaharey RK. Management of trans-anal extrusion of distal ventriculoperitoneal shunt catheter in children. Int J Res Med Sci. 2022;10(3):628-38.
45. Moges KT, Zewdie K. Distal shunt migration; A case series. SVOA Neurol. 2023;4:50-5.
46. Shbani A, Zainabo A, Zainabo R, Alsayed C, Ranjous N. Complex complications following ventriculoperitoneal shunt placement in Syria: A case report on multiple bowel perforations, migration, and obstruction. Int J Surg Case Rep. 2024;124:110348.

47. Renée BA, Takoutsing B, Paul MJ, Jibia A, Claude EV, Esene I. Trans-anal protrusion of the distal end of a ventriculoperitoneal shunt without peritonitis in a neonate: An unusual complication. Health Res Afr. 2025;3(2):1.
48. Park CK, Wang KC, Seo JK, Cho BK. Transoral protrusion of a peritoneal catheter: a case report and literature review. Childs Nerv Syst. 2000;16(3):184-9.
49. Berhouma M, Messerer M, Houissa S, Khaldi M. Transoral protrusion of a peritoneal catheter: a rare complication of ventriculoperitoneal shunt. Pediatr Neurosurg. 2008;44(2):169-71.
50. Low SW, Sein L, Yeo TT, Chou N. Migration of the abdominal catheter of a ventriculoperitoneal shunt into the mouth: a rare presentation. Malays J Med Sci. 2010;17(3):64-7.
51. Dua R, Jain R. Peroral extrusion of ventriculoperitoneal shunt: a case report and review of the literature. Cent Eur Neurosurg. 2011;72(2):107-8.
52. Gupta R, Mala TA, Gupta A, Paul R, Malla SA, Gupta AK. Transoral migration of peritoneal end of ventriculoperitoneal shunt with perforation of gastro-esophageal junction: a case report of a rare complication. Bangladesh J Med Sci. 2014;13(4):492-5.
53. Mandhan P, Wong M, Samarakkody U. Laparoendoscopic removal of peroral extrusion of a ventriculoperitoneal shunt. Asian J Endosc Surg. 2015;8(1):95-7.
54. Badri M, Gader G, Belkahla G, Kallel J, Zammel I. Transoral migration of the inferior end of a ventriculoperitoneal shunt: A case report with literature review. Neurochirurgie. 2018;64(3):203-5.
55. Feeney V, Ansar N, Donaldson-Hugh B, Alalade AF. Transoral protrusion of a ventriculoperitoneal catheter caused by jejunal perforation in an adult: Rare case report and review of the literature. World Neurosurg. 2020;137:200-5.
56. Ghritlaharey RK. Cerebrospinal fluid shunt catheter extrusion through the mouth in a child: a case report with brief literature review. Int Surg J. 2024;11(7):1168-75.
57. Jena RK, Sahoo SK, Sharma A. Laparoscopic management of trans-oral migration of VP shunt: A case report. Int J Life Sci Biotechnol Pharm Res. 2024;13:628-30.
58. Mevorach RA, Hulbert WC, Merguerian PA, Rabinowitz R. Perforation and intravesical erosion of a ventriculoperitoneal shunt in a child with an augmentation cystoplasty. J Urol. 1992;147(2):433-4.
59. Bavbek M, Simsek S. Urethral extrusion of distal shunt catheter. Türk Nöroşir Derg. 1996;6:130 2.
60. de Aguiar GB, Mizrahi C, Aquino JH, Tavares CM, Telles C, Nigri F, et al. Urethral extrusion of a peritoneal catheter in a patient with a neobladder: a rare complication of shunt insertion. Neuropediatrics. 2011;42(3):124-7.
61. Miranda ME, de Sousa MB, Tatsuo ES, Quites LV, Giannetti AV. Bladder perforation by ventriculoperitoneal shunt. Childs Nerv Syst. 2016;32(12):2321-6.
62. Ahmed N, Ahmed I, Safdar A, Zaidi H, Awan SH. Extrusion from urethral meatus and massive pleural effusion rare complications of ventriculoperitoneal shunt. Pak Armed Forces Med J. 2019;69(3):7157.
63. Obaidy Y, Sherzad A, Moghul D. Urethral migration of a ventriculoperitoneal shunt in a 6-month-old female infant: A rare complication of hydrocephalus management. Urol Case Rep. 2025;60:102998.
64. Pianetti Filho G, Cabral G, Fonseca LF, al Filho JA. Vaginal perforation as complication of ventriculo-peritoneal shunt: report of a case. Arq Neuropsiquiatr. 1991;49(3):362-4.
65. Bonfield CM, Weiner GM, Bradley MS, Engh JA. Vaginal extrusion of a ventriculo-peritoneal shunt catheter in an adult. J Neurosci Rural Pract. 2015;6(1):97-9.
66. Houten JK, Smith S, Schwartz AY. Vaginal migration of ventriculoperitoneal shunt catheter and cerebrospinal fluid leak as a complication of hysterectomy. World Neurosurg. 2017;104:1046.e13-4.
67. Soufiany I, Hijrat KA, Soufiany S, Chen L. Mechanisms and major sites of distal catheter migration in ventriculoperitoneal shunting maneuvers: A review article. Brain Sci Adv. 2018;4(2):141-55.
68. Lord S, Robinson T, Spurgas M. Ventriculoperitoneal shunt migration with vaginal extrusion via the fallopian tube. J Pediat Surg Case Rep. 2020;57:101468.
69. Park H, Lee KS, Lee KC. Perforation of the urinary bladder by the distal catheter: a rare complication of ventriculoperitoneal shunt. J Kor Neurosurgical Society. 1984;13:563-5.
70. Nagulic M, Djordjevic M, Samardzic M. Peritoneo-vulvar catheter extrusion after shunt operation. Childs Nerv Syst. 1996;12(4):222-3.
71. Arifin M, Purnomo F, Muttaqin Z, Bakhtiar Y, Andar E, Priambada D, et al. Cerebrospinal fluid contents and risk of shunt exposure in hydrocephalus. Bali Med J. 2019;8:661-3.
72. Kumar P, Pandey S, Bhakal N, Shrivastava S, Gupta LN, Jha RP. A retrospective study on ventriculoperitoneal shunt complications in a tertiary care centre. Indian J Neurosurg. 2020;9(3):170-4.
73. Faheem M, Jaiswal M, Prajapati HP, Kumar R, Saba Nu, Ojha BK. Unusual complications of ventriculoperitoneal shunt surgery: Tertiary care experience. J Pediatr Neurosci. 2022;17(1):30-5.
74. Venkati GS, Pandharinath NP, Shankar R. Tertiary centre experience with complications in VP shunt surgery. Int J Acad Med Pharm. 2024;6(1):2113-6.
75. Çiğdem G, Boleken ME. Abdominal complications after ventriculoperitoneal shunt placement in pediatric patients with hydrocephalus. Harran Üniversitesi Tıp Fakültesi Dergisi. 2025;22(1):172-8.

76. Abdelmageed S, Sarkar P, Shlobin NA, Davila DG, Potts MB. Laparoscopic-assisted peritoneal access in ventriculoperitoneal shunt placement: Systematic review and meta-analysis. Neurosurgery. 2025;96(4):734-43.
77. Mukumbya B, Adeleye AO, Siddig AHE, Mbilinyi RH, Woo J, Agwu C, et al. Outcomes of ventriculoperitoneal shunt surgery for hydrocephalus in children in low- and middle-income countries: a systematic review. J Neurosurg Pediatr. 2025;36(5):570-81.
78. Vlasak A, Okechi H, Horinek D, Albright AL. Pediatric ventriculoperitoneal shunts revision rate and costs in high-volume sub-Saharan Department. World Neurosurg. 2019;130:e1000-3.
79. Nguyen K, Gaskamp H, Walston M, Zamacona R, Stowers J, Seifi A. Trend of death in pediatric ventriculoperitoneal shunts in the United States. J Neurol Research. 2020;10(3):69-72.
80. Darko K, Guirguis M, Kakulamarri S, Farid M, Venkatesh P, Osei Adjei EK, et al. Presentation, management, and outcomes of pediatric hydrocephalus in Africa: a systematic review and meta-analysis of 12,355 patients. J Neurosurg Pediatr 2024;34(4):315-27.

Cite this article as: Ghritlaharey RK. Extrusion of ventriculoperitoneal shunt catheters through natural orifices: a comprehensive literature review. Int Surg J 2026;13:xxx-xx.