



HAL
open science

The management of perineal hernia following abdomino-perineal excision for cancer

Karen Bertrand, Jeremie H Lefevre, Ben Creavin, Minh Luong, Clotilde Debove, Thibault Voron, Najim Chafai, Emmanuel Tiret, Yann Parc

► **To cite this version:**

Karen Bertrand, Jeremie H Lefevre, Ben Creavin, Minh Luong, Clotilde Debove, et al.. The management of perineal hernia following abdomino-perineal excision for cancer. *Hernia*, 2020, 24 (2), pp.279-286. 10.1007/s10029-019-01927-7 . hal-03217698

HAL Id: hal-03217698

<https://hal.sorbonne-universite.fr/hal-03217698v1>

Submitted on 5 May 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**THE MANAGEMENT OF PERINEAL HERNIA FOLLOWING ABDOMINO
PERINEAL EXCISION FOR CANCER**

Karen BERTRAND¹, Jeremie H. LEFEVRE¹, Ben CREAVIN², Minh LUONG¹, Clotilde DEBOVE¹, Thibault VORON¹, Najim CHAFAI¹, Emmanuel TIRET¹, Yann PARC¹.

(1) Departments of Digestive and General Surgery, Hospital Saint-Antoine AP-HP,
Sorbonne Université, Paris, France.

(2) Department of Surgery, St Vincent's University Hospital, Elm Park, Dublin 4, Ireland

Original article

No Funding to declare

Correspondance and reprint requests:

Pr Jérémie H. Lefèvre, Department of Digestive Surgery, Hôpital Saint-Antoine, Assistance
Publique Hôpitaux de Paris, Université Pierre et Marie Curie, Paris VI, 184 rue du Faubourg
Saint-Antoine, 75012, Paris, France

Tel: 0033 1 49 28 25 47, Fax: 0033 1 49 28 25 48

e-mail: jeremie.lefevre@aphp.fr

Short running title: Perineal Hernia repair post abdominoperineal resection

Word count: 3354

INTRODUCTION

1 Abdomino-perineal resection (APR) is associated with significant morbidity, of which, perineal
2
3 hernia (PH) is a late and rare complication. PH occurs when abdominal organs protrude into the pelvic
4
5 floor with incidence ranging from <1% for symptomatic and 7% for asymptomatic. However, due to
6
7 the complexity of diagnosing and under reporting of such complication, the true incidence is unclear.
8
9

10 [1-3] . ~~Risk factors associated with this complication include obesity, diabetes, smoking,~~
11
12 ~~radiotherapy, extended resection, laparoscopy and method of pelvic reconstruction.~~ With the
13
14 increasing use of radiotherapy and extralevator resection, the incidence of PH may increase, with
15
16 more recent reports suggesting occurrence rates of 12%-26% [4, 5].
17
18

19 PH usually occurs within the first 2 post-operative years, with a median interval of ten months [1, 5].
20
21

22 Its diagnosis is clinical, with a bulging mass or pain and discomfort worse on standing or in the sitting
23
24 position being the commonest presentations. A CT scan or MRI during oncological follow up can aid
25
26 in diagnosis, however, patient positioning during scanning (supine) may reduce hernia detection rates.
27
28

29 Furthermore, there currently is no established radiological definition of PH.
30
31

32 Complications of PH include urinary dysfunction, skins erosions and bowel obstruction.
33
34

35 Surgical PH repair is indicated based on the severity of the complication along with patient reported
36
37 discomfort. Many repair options are described in the literature and are based on the approach
38
39 (perineal, abdominal, combined and laparoscopic) or on the technique (suture, pexy, synthetic and
40
41 biological mesh or flap). As this is a rare complication of APR, only few studies exist, mainly case
42
43 reports or studies with low numbers and short follow-up. As a result, no consensus can be established
44
45 on the optimal surgical management of PH.
46
47
48

49 The aim of this article was to describe the management of PH, analyze the recurrence and
50
51 complications rates and compare our center's results with current studies in the literature.
52
53
54
55
56

MATERIAL AND METHODS

Patients

1 We retrospectively included all consecutive patients who had a surgical PH repair at the Saint
2 Antoine's hospital (Paris, France) between April 2001 and July 2017. All patients had undergone an
3 APR for cancer as an index surgery (rectal adenocarcinoma or squamous cell carcinoma of the anus).
4
5 For each patient, we recorded demographic data (age, gender and comorbidities), first operation data
6
7 (tumor type and size, resection and reconstruction type, and postoperative follow up), PH symptoms
8
9 and date of diagnosis, PH repair surgery (hernia size, approach and type of repair) and follow up
10
11 (recurrence and morbidity as defined by the Clavien Dindo's classification [6]). Pathological staging
12
13 of the tumor was in accordance with the UICC classification. Patient charts were utilized for data
14
15 (paper and software), along with imagery software databases, and if needed, patients were contacted
16
17 directly. All data was anonymized.
18
19
20
21

22 *PH diagnosis*

23
24
25 PH diagnosis was based on patient reported symptoms (perineal swelling, discomfort, pain) or
26
27 complications (urinary dysfunction, obstruction and skin erosion), and clinical examination (bulging,
28
29 impulsive mass in a standing position or with coughing). A CT scan was performed when the clinical
30
31 diagnosis was questioned. We defined radiological PH as protrusion of abdominal viscera under the
32
33 level of coccyx and ischial bones [7] .
34
35
36

37 A surgical repair was proposed for all patients with a significant symptomatic hernia which impacted
38
39 on their quality of life or if complications were present due to the PH. Prior to surgery, all patients
40
41 underwent investigations to out rule a tumor recurrence (clinical examination, extensive CT scan of
42
43 thorax, abdomen and pelvis and tumor markers).
44
45
46

47 *Surgery*

48
49 Surgical repair of PH was based on surgeon preference. The perineal approach was preferentially
50
51 chosen in the department as it is a less invasive approach associated with a faster recovery. An
52
53 abdominal approach was mainly used if another procedure was necessary (hysterectomy, incisional
54
55 or parastomal hernia repair). A biological mesh was commonly used, mainly due to the location of
56
57
58
59
60
61
62
63
64
65

the hernia, presence of irradiated tissue and local infection history which raise postoperative mesh infection risks [8, 9].

Perineal approach

For the perineal approach, patients were placed in prone position. An elliptical incision was made around the previous perineal scar. The hernial sac was dissected and its contents reintroduced into the abdominal cavity. The hernial sac was either resected or closed and left in situ. Dissection was continued to the level of the levator ani muscle insertion. A mesh was cut and adapted to the size of hernial defect and fixed with interrupted non-absorbable sutures laterally to the levator muscle remnant, anteriorly to the pubis and posteriorly to the sacrum and coccyx. Subcutaneous tissue and skin were closed in two layers after a suction drain was placed in contact **with** the mesh to prevent collections.

Abdominal approach

When an abdominal approach was chosen, **lysis of all adhesions** of the abdominal cavity was performed and the perineal hernia content was reintroduced into the abdomen. The mesh was placed and anchored around the pelvic diaphragm (anteriorly to the pubis, prostate and vagina or uterus, laterally to the levator muscle remnant and posteriorly to the coccyx and the sacrum). A vacuum drain was also placed to prevent any postoperative collection.

When judged necessary a vertical rectus abdominis flap (VRAM) was performed in collaboration with a plastic team according to the technique described by Taylor and al. [10, 11].

Postoperative follow up

When the postoperative course was uneventful, patients were allowed to **eat, drink and mobilize**, except for patients with a flap reconstruction which necessitated a longer immobilization. Drains were removed when the secretion amount was less than 30mL a day or at the surgeon's discretion **depending on the output over the previous days**. Patients were discharged when they were pain free, had a healing perineal scar without a drain and on normal diet.

Clinical exam occurred one-month post discharge, with oncological follow up at the surgeon's discretion.

Early morbidity was defined as any complication during the first 90 postoperative days. Major complication was classified as ≥ 3 Clavien and Dindo classification score [6]. Recurrence was evaluated according to the patient symptoms and clinical examination. Radiological follow up was performed if a recurrence was suspected.

Literature review

A systematic review of the literature was performed on the electronic database Pubmed according to the following search terms: "Perineal" and "Hernia". We limited our search to English and French articles, published between 1960 and June 2017. Articles were selected first by title and abstract. Articles were excluded if the repair technique or the recurrence rate was not reported, if the sample size was < 3 repairs, case reports and if the article was for primary perineal hernia repair.

RESULTS

Patient characteristics

Between April 2001 and July 2017, twenty-one patients underwent perineal hernia repair for a symptomatic or complicated PH (15 women and 6 males). A total of 24 procedures were performed. Median age at the time of repair was 60.5 years old (range: 32-84 years). Preoperative patient characteristics are listed in the Table 1.

Only one patient in the cohort did not receive neoadjuvant treatment (95.2%). An APR was performed for 14 (66.7%) rectal adenocarcinomas and 7 anal squamous cell carcinomas.

A laparoscopic approach was performed in 11 (52.4%) index oncological resections. Details of the surgical procedure was known for only 17 patients with an extralevator resection representing 88.2% of the procedures (N=15). An omentoplasty was performed for all patients. Pelvic reconstruction consisted of direct closure in two layers for all patients except one who underwent a Gracilis flap.

1 Postoperative complications occurred in 9 patients (42.9%) including 6 perineal wound complications
2 (28.6%). Eight patients underwent adjuvant treatment (38.1%). The pathological reports were
3 available for 18 patients. The mean tumor size was 30 mm (range 0 to 100mm), 58% were classified
4 stage 1 or 2 (N=12) and 26% classified stage 3 or 4 (N=6).
5
6
7

8 9 10 *Perineal hernia characteristic (Table 2)*

11 PH diagnosis was made after a median of 16 months post APR (range 3 - 72 months). Discomfort
12 was the most frequent symptom reported by patients (87.5%), followed by increasing swelling size
13 (41.7%) and pain (12.5%). PH contents was described during surgery or on preoperative CT scans as
14 small bowel for 16 of the 21 patients (76.2%), omentum for ten (47.6%), uterus and/or bladder for
15 six (28.6%) and colon for two (9.2%). A PH complication occurred in 10 patients (41.7%): urinary
16 dysfunction (n=6), skin erosion (n=2) and bowel obstruction (n=2).
17
18
19
20
21
22
23
24
25
26

27 Prior to surgical repair of PH, an oncological recurrence was eliminated for all patients by tumor
28 markers and CT scans. A tumor recurrence was diagnosed and treated between the APR and PH
29 diagnosis in two patients: an inguinal recurrence of a squamous cell tumor treated by
30 chemoradiotherapy and nodal resection, and a local recurrence of a rectal adenocarcinoma localized
31 in the labia majora treated by surgical resection and chemotherapy. One further patient had a primary
32 diagnosis of endometrial adenocarcinoma, treated with a total hysterectomy at the time of PH repair.
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

1 The repair techniques included a biological mesh for 17 patients (70.8%), a synthetic mesh for 5
2 patients (20.8%) and a flap for 2 patients (8.3%). A drain was placed in the perineal cavity for all
3 patients bar two (91.7%).
4

5 The median operative time was 140 minutes (range 60-495). Median operative time for a perineal
6 approach was 135 minutes (Range 60-190), 160 minutes for an abdominal approach (Range 110-
7 380), and 315 minutes for a combined approach.
8
9

10 Overall median length of hospital stay (LOS) was 6 days (Range 3-15). Median LOS for a perineal
11 approach was 5.5 days (Range: 3-12), 7 days for an abdominal approach (Range: 6-12) and 7 days
12 for a combined approach.
13
14
15
16
17
18
19
20
21
22

23 *Postoperative course*

24 The median follow-up was 32.4 months from the PH repair (Range 1-75 months) and 60 months from
25 the APR (16-214 months).
26
27
28
29

30 No mortality occurred during follow up. Overall morbidity was 37.5% (n=9). A major complication
31 occurred in 3 patients (12.5%): one wound dehiscence on post-operative day one requiring an
32 emergency surgery with mesh repair, one obstruction secondary to a PH recurrence and one local
33 perineal infection requiring VAC therapy.
34
35
36
37
38
39

40 Minor complications occurred in 6 patients (25%): 3 urinary infections and 3 perineal healing
41 complications requiring wick packs to heal. Median complication rate for the perineal approach was
42 37.5% (N=6) (including 2 major complications), 20% for the abdominal approach (N=1, a minor
43 complication), and 66.7% for the combined approach (N=2). Complications occurred in 35.3% of
44 biological mesh repairs (N=6, including 2 major complications and 3 perineal healing issues) and
45 20% for the synthetic mesh repairs (N=1). During the entire follow up no mesh had to be removed.
46
47
48
49
50
51
52
53

54 A clinical recurrence occurred in ten patients (41.7%) after a median follow up of 9.2 months (range
55 1-44.6 months). Recurrences occurred in 47.1% of biological mesh repairs (N=8) and 40% of the
56 synthetic mesh repairs (N=2). No recurrence occurred in the flap group. Recurrences were seen in
57
58
59
60
61
62
63
64
65

50% of the perineal approach cohort (n=8) and 40% of the abdominal approach cohort (N=2). No recurrence was seen in the combined approach cohort. Results of the different techniques and approaches are summarized in the table 3. The median time to recurrence was 11 months for the biological mesh (between 1 and 43 months) and 27.2 months for the synthetic mesh.

Four patients underwent a major surgical procedure at the time of PH repair. Two hysterectomies were performed with no perineal hernia recurrence or post-operative complication. One incisional hernia treated by suture repair who subsequently had a PH recurrence 10 months after with no complication, and one incisional and parastomal hernia repaired by a perineal approach with acute urinary retention post op and a PH recurrence 9 months later.

Only two patients underwent reintervention (n=3) for PH recurrence, with the majority of patients declining further surgical intervention. Of the two patients who underwent further surgical management, one had a recurrence 44 months after the use of a synthetic mesh following an abdominal approach. A second repair was performed using a biological mesh through a perineal approach.. The patient was free from recurrence after 14 months follow up. The second recurrence occurred in a patient with a biological mesh repair through a perineal approach. This patient had an early recurrence three months after with a further surgery using the same approach and technique. A recurrence occurred one month after this with a concurrent bowel obstruction requiring an emergency surgery. The PH was treated by a combined approach using a Taylor flap with no recurrence reported in this patient after 9 months follow up.

When recurrence of PH was excluded in analysis, there was no difference in the PH recurrence rate: 42.9% for all surgeries, 50% and 40% for the perineal and abdominal approaches, and 46.7% and 40% for biological and synthetic meshes, respectively. Similarly, there was no difference in complication rates: 28.6% for all surgeries, 28.6% for the perineal approach and 26.7% for the biological mesh.

Literature review

1 Following a literature review, twelve studies describing the management of secondary PH were
2 published between 1964 and 2016 [1, 2, 4, 5, 12-19]. Median population size was 8.5 (n=130 patients
3 of which 138 surgeries were performed). Details of pooled studies are given in table 4. The perineal
4 approach (n=79) and the use of synthetic prosthesis (n=79) was the commonest approach and
5 technique performed. Recurrence rates ranged from 0 to 66.7% with a mean recurrence rate of 28%.
6 Recurrence rates were 14.3% for a flap repair, 24.1% for a synthetic mesh repair and 36.4% for a
7 biological mesh repair. According to pooled results found in the literature, an abdominal or
8 laparoscopic approach with synthetic mesh repair is associated with less recurrences (8.3 and 12.5%
9 respectively) and complications rates (30% and 9.5% respectively). Only four studies had a follow-
10 up > 24 months [1, 2, 8, 14], with five studies having no follow up reported or follow up of <12
11 months.

DISCUSSION

12 Due to improvements in surgical technologies and neoadjuvant treatments, the indications of APR
13 have decreased. ~~APR is still indicated for rectal adenocarcinomas invading the sphincter complex~~
14 ~~post neoadjuvant treatment and resistance or recurrence of anal squamous cell carcinoma following~~
15 ~~radio and chemotherapy.~~ PH represents a late but rare complication of APR. Real incidence of PH
16 after APR remains unknown and is probably underestimated in historical reports (<1% for
17 symptomatic and <7% for asymptomatic) [5] [1-3]. The decrease in APR indications is balanced by
18 an aggressive attitude in the treatment of rectal and anal tumors (larger surgical resection and more
19 intense neoadjuvant regime) and the use of laparoscopic surgery which is a suggested PH risk factors
20 [5, 8, 9, 20]. More recent studies show incidences of 1 to 26% after oncological resection [4, 5, 21]
21 ~~The real incidence of PH remains unclear, with heterogeneity seen in the populations reported in~~
22 ~~previous studies.~~

1 Since the first PH repair described by Yeomans in 1939, many repair methods have been reported
2 and have ultimately been based on the type of approach and technique of defect closure used. As this
3 is a rare complication of APR, the literature is mostly composed of case reports or studies of small
4 population size and poor methodology (~~short follow-up and postoperative complications often not~~
5 ~~describe~~). Furthermore, in small population studies, authors may have the tendency to publish
6 preferentially good results. No consensus on the optimal operative method to repair PH after APR
7 can be established from the current literature.

8 Recurrences following PH repair are high in some studies with rates up to 66% with no repair
9 technique significantly reducing recurrence rates. The abdominal approach seems to have less
10 recurrence than the perineal approach (respectively 40% versus 50% in the present study and 15%
11 versus 38% in the literature). Advantages to the abdominal approach include better exposure, the
12 ability to perform another procedure at the time of repair and perform a diagnostic exploration of the
13 abdomen to assess oncological recurrence. However, the postoperative recovery may be longer.
14 (~~extended operative time and hospitalization length of stay, more painful approach and increased risk~~
15 ~~of post-operative ileus~~). The perineal approach seems to be the less invasive method with a faster
16 postoperative recovery as operative time is reduced and the risk of postoperative ileus is lower.
17 Furthermore, re-opening the abdominal scar is not required reducing the risk of wound hernia.
18 However, good knowledge of the pelvic region anatomy is needed to fix the mesh sparing nerve,
19 vessels and ureteral damage. The limited exposure associated with this approach may make mesh
20 fixation difficult leading to the increased risk of recurrence [2, 17]. It seems to be an interesting first
21 approach for small hernia or patient with significant comorbidities. Our department did not perform
22 PH repair by a laparoscopic approach. A laparoscopic approach has been reported in the literature,
23 with 27 patients in the literature review performed in this study (representing 19.5% of the 138
24 patients) undergoing a laparoscopic approach with a recurrence rate of 14.8%. It seems to be an
25 interesting and achievable approach, but patient selection is paramount. This approach is not suitable

for large hernia or patient with multiple prior surgeries with high risk of small bowel injury. No data on robotic approach have been published so far.

Similar recurrence rates are seen in the type of mesh (biological or synthetic) used (47.1% versus 40% in the present study and 36.4% versus 24.1% in the literature). Due to their expensive cost, biological mesh must be reserved for high risk populations (long history of chronic pelvic sepsis, high irradiated tissues, enterocutaneous fistula and bowel injury during dissection). Some authors have suggested that biological mesh could contribute to late recurrences due to their slow and progressive resorption. [16]. However, the use of synthetic mesh remains a good option in the absence of pelvic floor infection and when the peritoneum can be totally closed. Synthetic mesh repair is associated with complications including bowel obstruction, fistulas and may complicate a future reintervention. There is paucity in the literature with regard to mesh complications post PH repair currently. More studies are needed to investigate the complications of each form of mesh repair.

Flap reconstructions have good results (14.3% recurrence rate) but must be reserved for complex or recurrent PH in patients fit for a more invasive surgical repair (increased operative time, postoperative immobilization, donor-site morbidity and complication rate). Myocutaneous flaps seem to be more expensive than a biological mesh due to the cost of the hospitalization, patient immobilization and nursing [22]. VRAM flaps have been shown to reduce PH post APR perineal repair compared with myocutaneous or fasciocutaneous gluteal flaps [23].

Limitations of the present study include its retrospective nature with a small sample size. ~~The methodology restriction is due to the rarity of PH and the necessity to include patients for a long period.~~ However, this study adds to the limited literature currently on the topic of PH management, presenting concise outcome data on the different approaches and techniques for repair. Recurrence rates in the present study are higher than in previous reports (mean recurrence rate of 27% in the literature versus 37.5% in the present study). This difference can be explained by the absence of consensual definition of recurrence (based only on patient feeling pain or discomfort, clinical examination or radiological imagery). Clinical diagnosis of hernia is complex in patients with chronic

1 pain and perineal wound inflammation secondary to multiple surgeries and radiotherapy. Some
2 patients with recurrence still complained of symptoms post PH repair. Furthermore, some patients
3 attribute functional symptoms to the initial hernia despite full resolution and repair of the PH.
4 We limited our inclusion criteria to APR for cancer, although, some articles included APR for
5 inflammatory bowel disease. An oncological resection requiring wider margins could influence
6 results leading to bigger PH defects and may influence the tissue available for anchoring the mesh
7 during the repair. Previous studies also failed to report complications and used different definitions
8 of PH which further adds to the differences seen in the present study.
9

10 Follow up in the present study may influence recurrence outcomes. Although median follow up was
11 **25 months, one patient** had short follow up (one month). The same problem is found in other studies
12 of the literature **with only five studies with a follow up > 24 months**. This follow up might be too
13 short since recurrence can occur after two years following repair. **We were not able to pool follow up**
14 **data based on the technique used as the various articles did not detail this.**

15 More studies are necessary to determine the real incidence of PH after oncological APR and identify
16 risk factor for its occurrence. ~~Many risk factors were investigated: female sex, diabetes, tobacco, age,~~
17 ~~obesity, radiotherapy, laparoscopy and perineal wound left open. There is some divergence in the~~
18 ~~literature with the majority of risk factors not being able to be avoided.~~ However, better identification
19 of patient PH risk could tailor surgical repairs for individual patients, especially in the reconstruction
20 technique used during the APR. It is assumed that all reconstruction technique of the pelvic floor
21 during APR do not lead to the same PH rate [21, 24]. In our department we routinely perform a
22 VRAM flap reconstruction after APR for anal squamous carcinoma due to the size of the cutaneous
23 resection. This procedure has shown good result in PH prevention without increasing complication
24 outcomes [11]. For adenocarcinoma populations with high PH risk factor, a similar protocol could be
25 proposed, preventing synthetic mesh placement in perineal reconstruction. ~~However, outcomes of~~
26 ~~studies assessing biological mesh reconstruction as opposed to synthetic mesh repair after APR are~~
27 ~~required to highlight the associated complications of both techniques.~~

1 CONCLUSION

2
3 Many PH repair methods have been described in the literature based on the approach (abdominal,
4 perineal, combined or laparoscopic) and technique (suture, pexy, biological or synthetic mesh or flap)
5
6 of the repair. Due to the paucity of literature on the topic, conclusions on the best repair method can't
7
8 be drawn as high recurrence rates are found for each technique. More studies are necessary to prevent
9
10 PH by identifying patients with PH risk factors and deciding the appropriate perineal reconstruction
11
12 during index APR. In our daily practice, we prefer a perineal approach with use of a mesh as a first
13
14 step for PH. In case of recurrence after previous repair or in case of large defect with skin lesion, an
15
16 abdominal approach with a VRAM give excellent results but with increased morbidity.
17
18
19
20
21
22
23
24

25 REFERENCES

- 26
27
28
29
30 1. Aboian E, Winter DC, Metcalf DR, Wolff BG. Perineal hernia after proctectomy: prevalence, risks,
31 and management. *Dis Colon Rectum* 2006; **49**: 1564-8.
32
33 2. Beck DE, Fazio VW, Jagelman DG, Lavery IC, McGonagle BA. Postoperative perineal hernia. *Dis*
34 *Colon Rectum* 1987; **30**: 21-4.
35
36 3. Hullsiek HE. Perineal hernia following abdominoperineal resection. *Am J Surg* 1956; **92**: 735-8.
37
38 4. Martijnse IS, Holman F, Nieuwenhuijzen GA, Rutten HJ, Nienhuijs SW. Perineal hernia repair after
39 abdominoperineal rectal excision. *Dis Colon Rectum* 2012; **55**: 90-5.
40
41 5. Sayers AE, Patel RK, Hunter IA. Perineal hernia formation following extralevator abdominoperineal
42 excision. *Colorectal Dis* 2015; **17**: 351-5.
43
44 6. Clavien PA, Barkun J, de Oliveira ML, Vauthey JN, Dindo D, Schulick RD, et al. The Clavien-Dindo
45 classification of surgical complications: five-year experience. *Ann Surg* 2009; **250**: 187-96.
46
47 7. Narang SK, Alam NN, Kockerling F, Daniels IR, Smart NJ. Repair of Perineal Hernia Following
48 Abdominoperineal Excision with Biological Mesh: A Systematic Review. *Front Surg* 2016; **3**: 49.
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
8. Chadwick MA, Vieten D, Pettitt E, Dixon AR, Roe AM. Short course preoperative radiotherapy is the single most important risk factor for perineal wound complications after abdominoperineal excision of the rectum. *Colorectal Dis* 2006; **8**: 756-61.
9. Bullard KM, Trudel JL, Baxter NN, Rothenberger DA. Primary perineal wound closure after preoperative radiotherapy and abdominoperineal resection has a high incidence of wound failure. *Dis Colon Rectum* 2005; **48**: 438-43.
10. Taylor GI, Corlett R, Boyd JB. The extended deep inferior epigastric flap: a clinical technique. *Plast Reconstr Surg* 1983; **72**: 751-65.
11. Lefevre JH, Parc Y, Kerneis S, Shields C, Touboul E, Chaouat M, et al. Abdomino-perineal resection for anal cancer: impact of a vertical rectus abdominis myocutaneous flap on survival, recurrence, morbidity, and wound healing. *Ann Surg* 2009; **250**: 707-11.
12. Abbas Y, Garner J. Laparoscopic and perineal approaches to perineal hernia repair. *Tech Coloproctol* 2014; **18**: 361-4.
13. Allen SK, Schwab K, Day A, Singh-Ranger D, Rockall TA. Laparoscopic repair of postoperative perineal hernia using a two-mesh technique. *Colorectal Dis* 2015; **17**: O70-3.
14. Musters GD, Lapid O, Stoker J, Musters BF, Bemelman WA, Tanis PJ. Is there a place for a biological mesh in perineal hernia repair? *Hernia* 2016; **20**: 747-54.
15. Goedhart-de Haan AM, Langenhoff BS, Petersen D, Verheijen PM. Laparoscopic repair of perineal hernia after abdominoperineal excision. *Hernia* 2016; **20**: 741-6.
16. Mjoli M, Sloothaak DA, Buskens CJ, Bemelman WA, Tanis PJ. Perineal hernia repair after abdominoperineal resection: a pooled analysis. *Colorectal Dis* 2012; **14**: e400-6.
17. So JB, Palmer MT, Shellito PC. Postoperative perineal hernia. *Dis Colon Rectum* 1997; **40**: 954-7.
18. Dulucq JL, Wintringer P, Mahajna A. Laparoscopic repair of postoperative perineal hernia. *Surg Endosc* 2006; **20**: 414-8.
19. Ego-Aguirre E, Spratt JS, Jr., Butcher HR, Jr., Bricker EM. Repair of Perineal Hernias Developing Subsequent to Pelvic Exenteration. *Ann Surg* 1964; **159**: 66-71.
20. Stone HB, Coleman CN, Anscher MS, McBride WH. Effects of radiation on normal tissue: consequences and mechanisms. *Lancet Oncol* 2003; **4**: 529-36.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

21. Musters GD, Klaver CEL, Bosker RJI, Burger JWA, van Duijvendijk P, van Etten B, et al. Biological Mesh Closure of the Pelvic Floor After Extralevator Abdominoperineal Resection for Rectal Cancer: A Multicenter Randomized Controlled Trial (the BIOPEX-study). *Ann Surg* 2017; **265**: 1074-81.

22. Peacock O, Pandya H, Sharp T, Hurst NG, Speake WJ, Tierney GM, et al. Biological mesh reconstruction of perineal wounds following enhanced abdominoperineal excision of rectum (APER). *Int J Colorectal Dis* 2012; **27**: 475-82.

23. Foster JD, Pathak S, Smart NJ, Branagan G, Longman RJ, Thomas MG, et al. Reconstruction of the perineum following extralevator abdominoperineal excision for carcinoma of the lower rectum: a systematic review. *Colorectal Dis* 2012; **14**: 1052-9.

24. Christensen HK, Nerstrom P, Tei T, Laurberg S. Perineal repair after extralevator abdominoperineal excision for low rectal cancer. *Dis Colon Rectum* 2011; **54**: 711-7.

Characteristics	N=21
Gender (M/F)	6/15
Age (y)	60.5 (32-84)
BMI	23.6(20-45)
Neoadjuvant treatment	20 (95.2%)
Long course radiotherapy	16 (76.2%)
Short course radiotherapy	4 (19%)
Primary disease N (%)	
Adenocarcinoma	14 (66.7%)
Squamous cell carcinoma	7 (33.3%)
Stage	
I-II	12 (58%)
III-IV	6 (26%)
NA	3 (14.3%)
Tumoral size (mm)	30 (0-100)
Resection R1	0 (0%)
Laparoscopy	11 (52.4%)
Omentoplasty	21 (100%)
Perineal closure	3/17 (17.6%)
Pelvic reconstruction	
Simple suture	20 (95.2%)
Muscle flap	1 (4.8%)
Adjuvant treatment	8 (38.1%)
Complications post APR	9 (42.9%)
Perineal wound infection	6 (28.6%)
Interval APR/PH diagnosis (month)	16 (3-72)
Interval PH diagnosis/PH repair (month)	5.5 (1-166)

Continuous variables are given as median (IQR)

Table 1. Patient and tumor characteristics.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

Symptoms	N (%)
Discomfort	21 (87.5%)
Pain	3 (12.5%)
Increasing size	10 (41.7%)
Urinary trouble	6 (25%)
Skin erosion	2 (8.3%)
Bowel obstruction	2 (8.3%)

Table 2. Perineal hernia symptoms before surgical repair (N=24).

15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

	Tot N (%)	Operation time med min (IQR)	Hospitalization length of stay med day (IQR)	Complications N (%)	Recurrences N (%)	Interval PH repair/recurrence month med (IQR)	Follow up month med (IQR)
<u>Approach type</u>							
Perineal	16 (66.7%)	135 (60-190)	5.5 (3-12)	6 (37.5%)	8 (50%)	7.9 (1-43)	26.4 (1-64)
Abdominal	5 (20.8%)	160 (110-380)	7 (6-12)	1 (20%)	2 (40%)	27 (9-44)	25 (1-45)
Combined	3 (12.5%)	315 (150-495)	7 (7-15)	2 (66.7%)	0 (0%)	-	50 (16-75)
<u>Technique repair</u>							
Biological mesh	17 (70.8%)	138 (60-380)	6 (3-12)	6 (35.3%)	8 (47.1%)	11 (1-43)	25 (1-64)
Synthetic mesh	5 (20.8%)	150 (110-185)	7 (6-7)	1 (20%)	2 (40%)	27.2 (9-44)	16 (1-45)
Muscle flap	2 (8.3%)	405 (315-495)	11 (7-15)	2 (100%)	0 (0%)	-	63 (50-75)
Total	24 (100%)	140 (60-495)	6 (3-15)	9 (37.5%)	10 (41.7%)	9.2 (1-44)	29 (1-75)

Table 3. Hernial repair: recurrences and complications after 24 procedures.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

	Raphie/Pexy/ graft/other	Synthetic mesh	Biologic Mesh	Flap	Total
Abdominal					
N	4	12	2	-	20
Recurrence	0/4 (0%)	1/12 (8.3%)	0/2 (0%)		3/20 (15%)
Complication	0/2 (0%)	3/10 (30%)	0/1 (0%)		4/15 (26.7%)
Perineal					
N	19	42	14	4	79
Recurrence	8/19 (42.1%)	15/42 (35.7%)	7/14 (50%)	0/4 (0%)	30/75 (38%)
Complication	5/9 (55.6%)	8/37 (21.6%)	0/2 (0%)	UNK	12/48 (27.1%)
Laparoscopic					
N	2	24	1	-	27
Recurrence	½ (50%)	3/24 (12.5%)	0%		4/27 (14.8%)
Complication	UNK	2/21 (9.5%)	UNK		2/21 (9.5%)
Combined					
N	3	1	-	-	4
Recurrence	0/3 (0%)	0/1 (0%)			0/4 (0%)
Complication	UNK	UNK			UNK
Total					
N	28	79	22	7	138
Recurrence	9/28 (32.1%)	19/79 (24.1%)	8/22 (36.4%)	1/7 (14.3%)	39/138 (28.3%)
Complication	5/11 (45.5%)	13/68 (19.1%)	0/3 (0%)	UNK	19/84 (22.6%)

Table 4. Literature review pooled results of surgical repair of perineal hernia.

First author	Patients	Technic (Approach/Method)	Recurrence %	Complication %
Ego-aguirre [19]	N=9	Perineal/Suture N=6	66.7% (4)	50% (3)
		Perineal/Synthetic N=3	66.7% (2)	66.7% (2)
		Redo surgery		
		Perineal/Suture N=3	66.7 (2)	
		Perineal/Synthetic N=1	0%	0%
Beck [2]	N=10	Abdominal N=2	100% (2)	50% (1)
		Perineal/Synthetic N=2	100% (2)	0%
Allen [13]	N=6	Abdominal/Synthetic N=8	12.5% (1)	37.5% (3)
		Laparoscopy/Synthetic N=5	0%	33.3% (2)
Musters [14]	N=6	Combined/Synthetic N=1	0%	
		Perineal/Biologic N=11	63,6% (7)	
So [17]	N=15	Perineal/Flap N=3	0%	20% (3)
		Abdominal/Biologic N=1	0%	
		Perineal/Synthetic N=4	25% (1)	
Aboian [1]	N=19	Perineal/Suture N=8	25% (2)	
		Perineal/Flap N=1	0%	21.1% (4)
		Abdominal/Synthetic N=1	0%	
		Abdominal/Suture N=2	0%	
		Combined/Suture N=3	0%	
Martijnse [4]	N=8	Abdominal/Suture N=2		0%
		Abdominal/Synthetic N=2		0%
		Perineal/Suture N=2	0%	50% (1)
		Perineal/Synthetic N=2		50% (1)
Mjoli [16]	N=29	Perineal/Synthetic N=29	31% (9)	17.2 (5)
Abbas [12]	N=3	Perineal/Biologic N=2	0%	0%
		Abdominal/Biologic N=1	0%	0%
Goedhart-de Haan [15]	N=7	Laparoscopy/Synthetic N=3		
		Laparoscopy/Biologic N=1		
		Laparoscopy/Suture N=1	0%	14.3% (1)
		Perineal/Biologic N=1		
		Abdominal/Synthetic N=1		
Sayers [5]	N=12	Laparoscopy/Synthetic N=12	25% (3)	8.3% (1)
		Biologic N=5	20%(1)	
Dulucq [18]	N=8	Flap N=3	33.3%(1)	UNK
		Laparoscopy/Synthetic N=4	0%	0%
		Laparoscopy/Suture N=1	100%(1)	UNK
		Perineal/Synthetic N=1	100%(1)	UNK

Table 5. Literature review detail.



Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.



Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.



Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.



Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.



Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.



Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.



Please wait...

If this message is not eventually replaced by the proper contents of the document, your PDF viewer may not be able to display this type of document.

You can upgrade to the latest version of Adobe Reader for Windows®, Mac, or Linux® by visiting http://www.adobe.com/go/reader_download.

For more assistance with Adobe Reader visit <http://www.adobe.com/go/acrreader>.

Windows is either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries. Mac is a trademark of Apple Inc., registered in the United States and other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries.