

# Meta Analysis of Rectal Cancer Studies

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Data source:	rectal cancer statistic_neu.xlsx
Data supplied by:	Karl Kowalewski
Abstract:	[ToDo]



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New names:
* 'Abdominal pain post op lap' -> 'Abdominal pain post op lap34'
* 'Abdominal pain post op lap (SD)' -> 'Abdominal pain post op lap (SD)35'
* 'Abdominal pain post op rob' -> 'Abdominal pain post op rob36'
* 'Abdominal pain post op rob (SD)' -> 'Abdominal pain post op rob (SD)37'
* 'Abdominal pain post op lap' -> 'Abdominal pain post op lap80'
* and 3 more problems
New names:
<pre>* 'LAP directly postop (wert)' -&gt; 'LAP directly postop (wert)18'</pre>
<pre>* 'LAP directly postop (wert)' -&gt; 'LAP directly postop (wert)19'</pre>
<pre>* 'Postop 3 months rob (wert)' -&gt; 'Postop 3 months rob (wert)20'</pre>
* 'Postop 3months rob (Abweichung)' -> 'Postop 3months rob (Abweichung)21'
<pre>* 'Postop 3 months rob (wert)' -&gt; 'Postop 3 months rob (wert)24'</pre>

```
* ... and 1 more problem
```

## **1** Urinary Retention

Robotic treatment (experimatal group) compared to laproscopic treatment (control group). Results on the OR-scale (non-logarithmic). In case of 0 events in a study-arm, 0.5 is added to each arm of this study for continuity correction. Assuming that "urinary retention" is an undesirable event, OR < 1 favors Rob, while OR > 1 favors Lab. Studies are sorted by total sample size (from small to large) in the forest plot.

Study or		Rob		Lap	Odds Ratio		Odds	Ratio	
Subgroup	Events	Total	Events	Total	MH, Random, 95% C	I N	IH, Rando	om, 95% C	
RCT = no									
Kamali, D., ELAPE 2017	1	10	2	10	0.44 [0.03; 5.88]	-	•		
Barnajian, M. 2014	0	20	1	20	0.32 [0.01; 8.26]		•		
Gorgun, E. 2016	7	29	5	27	1.40 [0.39; 5.09]			•	
Allemann, P. 2016	1	20	2	40	1.00 [0.09; 11.74]				
Fernandez, R. 2013	5	13	18	59	1.42 [0.41; 4.96]			•	
Morelli, L. 2016	4	50	1	25	2.09 [0.22; 19.73]			•	
Serin, K. R 2015	0	14	1	65	1.48 [0.06; 38.28]			•	_
Park, S. Y. 2013	1	40	1	40	1.00 [0.06; 16.56]				
Aselmann, H. 2018	0	44	3	41	0.12 [0.01; 2.47]		•		
Levic, K. 2015	1	36	1	56	1.57 [0.10; 25.95]			•	
Park, J. S. 2010	0	41	2	82	0.39 [0.02; 8.27]		•		
Silva-Velazco, J. 2016	10	66	15	118	1.23 [0.52; 2.91]		_		
Yang 2018	1	91	4	102	0.27 [0.03; 2.48]	-	•		
Park, J. S. 2015	5	106	10	106	0.48 [0.16; 1.44]			_	
Kim, H. J. 2018	1	120	2	120	0.50 [0.04; 5.54]				
Kang, J. 2013	4	165	7	165	0.56 [0.16; 1.95]				
Law, W. L. 2017	9	220	18	171	0.36 [0.16; 0.83]				
Yamaguchi, T. 2016	5	203	18	239	0.31 [0.11; 0.85]				
Bo, T. 2019	1	556	1	1139	2.05 [0.13; 32.84]			•	-
Total (95% Cl)	2	1844		2625	0.65 [0.46; 0.92]		+		
Heterogeneity: Tau <sup>2</sup> = 0; C Test for overall effect: Z = -	hi <sup>2</sup> = 14.0 ·2.42 (P =	)8, df = : 0.02)	18 (P = 0	).72); l <sup>2</sup>	= 0%				
RCT = ves									
Patriti A 2009	1	29	1	37	1 29 [0 08· 21 47]			+	
Total (95% CI)		29		37	1.29 [0.08: 21.47]				
Heterogeneity: not applicat	ole	20		01	1.20 [0.00, 21.47]				
Test for overall effect: $Z = 0$	0.17 (P =	0.86)							
Heterogeneity: $Tau^2 = 0$ C	Γ		1						
Test for subaroup difference	0.01	01 1	10	100					
3		- · · · <b>-</b> ,	. (.		,	Fa	vors Rob	Favors La	ap

#### Figure 1: Forest plot for meta-analysis of urinary retention

Number of studies combined: k = 20



```
OR
                                       95%-CI
                                                   z p-value
Random effects model 0.6561 [0.4636; 0.9286] -2.38 0.0174
Quantifying heterogeneity:
tau^2 = 0; H = 1.00 [1.00; 1.20]; I^2 = 0.0\% [0.0\%; 30.8\%]
Quantifying residual heterogeneity:
H = 1.00 [1.00; 1.24]; I^2 = 0.0\% [0.0%; 34.7%]
Test of heterogeneity:
     Q d.f. p-value
        19 0.7659
 14.30
Results for subgroups (random effects model):
            k
                  OR
                                 95%-CI
                                            Q tau<sup>2</sup> I<sup>2</sup>
RCT = no
           19 0.6494 [0.4576; 0.9215] 14.08
                                                   0 0.0%
RCT = yes 1 1.2857 [0.0770; 21.4725] 0.00
Test for subgroup differences (random effects model):
                     Q d.f. p-value
                          1 0.6370
Between groups
                 0.22
Details on meta-analytical method:
- Mantel-Haenszel method
- DerSimonian-Laird estimator for tau<sup>2</sup>
```

- Continuity correction of 0.5 in studies with zero cell frequencies







#### 2 lleus

Robotic treatment (experimental group) compared to laproscopic treatment (control group). Results on the OR-scale (non-logarithmic). In case of 0 events in a study-arm, 0.5 is added to each arm of this study for continuity correction. Assuming that "ileus" is an undesirable event, OR < 1 favors Rob, while OR > 1 favors Lab. Studies are sorted by total sample size (from small to large) in the forest plot.

Study or		Rob		Lap	Odds Ratio	Odds Ratio
Subgroup	Events	Total	Events	Total	MH, Random, 95% C	I MH, Random, 95% Cl
RCT = no						
Koh, F. H. 2014	1	19	4	19	0.21 [0.02; 2.07]	
Barnajian, M. 2014	2	20	1	20	2.11 [0.18; 25.35]	
Gorgun, E. 2016	4	29	8	27	0.38 [0.10; 1.45]	
Allemann, P. 2016	1	20	0	40	6.23 [0.24; 160.03]	
Bedirli, A. 2016	1	35	0	28	2.48 [0.10; 63.21]	
Serin, K. R. 2015	0	14	1	56	1.28 [0.05; 32.98]	
Morelli, L. 2016	4	50	3	25	0.64 [0.13; 3.10]	
Huang, Y. M. 2017	0	40	4	38	0.09 [0.00; 1.82]	
Baek, J. H. 2011	3	41	2	41	1.54 [0.24; 9.73]	
Shiomi, A. 2016	1	52	2	30	0.27 [0.02; 3.16]	
Young, M. T. 2014	3	45	3	38	0.83 [0.16; 4.39]	
Aselmann, H. 2018	0	44	4	41	0.09 [0.00; 1.80]	
Levic, K. 2015	1	56	0	36	1.97 [0.08; 49.76]	
Feroci, F. 2016	3	53	4	58	0.81 [0.17; 3.80]	
Colombo, P. E. 2016	7	60	6	60	1.19 [0.37; 3.77]	
Panteleimonitis, S. 2018	2	62	4	61	0.48 0.08; 2.69	
Saklani, A. P. 2013	2	74	3	64	0.56 0.09; 3.49	
lelpo, B. 2014	4	56	6	87	1.04 0.28; 3.86	
Park, J. S. 2011	1	52	1	123	2.39 [0.15; 38.99]	
Ishihara, S. 2018	1	90	6	90	0.16 0.02: 1.33	<del></del>
Ahmed, J. 2017	13	99	12	85	0.92 0.40: 2.14	
Silva-Velazco, J. 2016	14	66	21	118	1.24 0.58: 2.65	_ <b>-</b>
Park, E. J. 2015	3	133	3	84	0.62 0.12: 3.16	
Kang, J. 2013	6	165	9	165	0.65 [0.23: 1.88]	
Garfinkle R 2018	23	154	31	213	1 03 [0 57 1 85]	
Law W. L. 2017	16	220	10	171	1 26 [0 56: 2 86]	<b>_</b>
Kim J 2017	27	224	12	224	2 42 [1 19 4 91]	_ <b>_</b>
Kim J C 2016	17	533	16	486	0.97 [0.48 1.94]	
Bo T 2019	7	556	9	1139	1 60 [0 59 4 32]	_ <b>.</b>
Moghadamyeghaneh 7 2015	131	872	910	4737	0.74 [0.61 0.91]	<b>—</b>
Feinberg A F 2016	44	472	875	8392	0.88 [0.64 1.21]	7
Total (95% CI)		4406	010	16796	0.86 [0.75] 0.981	•
Heterogeneity: $Tau^2 = 0$ ; $Chi^2 = 2$ Test for overall effect: $Z = -2.19$ (	29.72, df = P = 0.03)	= 30 (P	= 0.48); l <sup>2</sup>	<sup>2</sup> = 0%	0.00 [0.00, 0.00]	
RCT = yes						
Debakey, Y. 2018	2	24	3	21	0.55 [0.08; 3.63]	
Patriti, A. 2009	2	29	1	37	2.67 [0.23; 30.96]	
Kim, M. J. 2018	6	66	9	73	0.71 [0.24; 2.12]	— <mark>—</mark> —
Total (95% CI)		119		131	0.80 [0.33; 1.93]	-
Heterogeneity: $Tau^2 = 0$ ; $Chi^2 = 1$ Test for overall effect: $Z = -0.50$ (	.13, df = P = 0.61)	2 (P =	0.57); I <sup>2</sup> =	0%		
Heterogeneity: $Tau^2 = 0$ ; $Chi^2 = 3$	0.87, df =	= 33 (P	= 0.57); l <sup>2</sup>	<sup>2</sup> = 0%		
Test for subgroup differences: Ch	$ni^2 = 0.03$	, df = 1	(P = 0.87	)		0.01 0.1 1 10 100
						Favors Rob Favors Lap

Figure 3: Forest plot for meta-analysis of Ileus

Number of studies combined: k = 34



```
z p-value
                         OR
                                      95%-CI
Random effects model 0.8578 [0.7503; 0.9807] -2.24 0.0248
Quantifying heterogeneity:
tau<sup>2</sup> = 0; H = 1.00 [1.00; 1.24]; I<sup>2</sup> = 0.0% [0.0%; 34.5%]
Quantifying residual heterogeneity:
H = 1.00 [1.00; 1.26]; I^2 = 0.0\% [0.0\%; 36.9\%]
Test of heterogeneity:
     Q d.f. p-value
30.87 33 0.5735
Results for subgroups (random effects model):
           k
                 OR
                               95%-CI
                                         Q tau^2 I^2
RCT = no 31 0.8593 [0.7504; 0.9840] 29.72 0 0.0%
RCT = yes 3 0.7967 [0.3297; 1.9253] 1.13
                                               0 0.0%
Test for subgroup differences (random effects model):
                    Q d.f. p-value
Between groups
                 0.03 1 0.8681
Details on meta-analytical method:
- Mantel-Haenszel method
- DerSimonian-Laird estimator for tau<sup>2</sup>
- Continuity correction of 0.5 in studies with zero cell frequencies
```





Figure 4: Funnel plot for meta-analysis of Ileus

# 3 QLQ-Scores

Robotic treatment (experimental group) compared to laproscopic treatment (control group). Results as difference in means. Designations in the forest plot assume a higher mean differences to be better in all cases which translates into a higher score being assumed better.



#### 3.1 QLQ-C-29

RobLabMean DifferenceStudyMeanSD Total MeanSD Total IV, Random, 95% CIKamali, D., ELAPE 201774.0014.000099Heterogeneity: Tau<sup>2</sup> = NA; Chi<sup>2</sup> = 0.00, df = 0 (P = NA); I<sup>2</sup> = NA%100.70 [-11.91; 13.31]-10-50510Favors LabFavors Rob

#### Figure 5: Forest plot for meta-analysis of QLQ-C-29 global health

MD		95%-CI	z	p-value
0.7000	[-11.9076;	13.3076]	0.11	0.9133

#### Details:

- Inverse variance method





#### 3.2 QLQ-C-30

Study	Mean	Rob SD	Total	Mean	Lab SD	Total	Mean Difference IV, Random, 95% 0	3	Mear IV, Rai	n Differ ndom, 9	ence ∂5% Cl	
Kamali, D., AR 2017	77.40	23.4000	14	74.40	23.4000	15	3.00 [-14.04; 20.04	1		-++		
Kamali, D., ELAPE 2017	74.00	14.0000	9	73.30	14.0000	10	0.70 [-11.91; 13.31	1				
Kim, H. J. 2018	65.00	4.0000	130	62.00	4.0000	130	3.00 [ 2.03; 3.97]	ī				
Heterogeneity: Tau <sup>2</sup> = 0; C	hi <sup>2</sup> = 0.1	13, df = 2	(P = 0.9)	94); I <sup>2</sup> =	0%					1		1
								-20	-10	0	10	20
									Favors L	ab Fa	vors Rob	)

#### Figure 7: Forest plot for meta-analysis of QLQ-C-30 global health

Number of studies combined: k = 3



MD 95%-CI z p-value Random effects model 2.9864 [2.0185; 3.9544] 6.05 < 0.0001

Quantifying heterogeneity: tau<sup>2</sup> = 0; H = 1.00 [1.00; 1.00]; I<sup>2</sup> = 0.0% [0.0%; 0.0%]

Test of heterogeneity: Q d.f. p-value 0.13 2 0.9384

Details on meta-analytical method:Inverse variance methodDerSimonian-Laird estimator for tau<sup>2</sup>



Figure 8: Funnel plot for meta-analysis of QLQ-C-30 global health



#### 4 IIEF Total Scores

Robotic treatment (experimental group) compared to laproscopic treatment (control group). Results as mean differences and assuming a higher score being better. Assuming that the data is assymtotically normal (especially symmetric) in the studies reporting median and range, mean and standard deviation are estimated.



Figure 9: Forest plot for meta-analysis of IIEF at latest time point available, sorted by time of measurement from earliest to latest

```
Number of studies combined: k = 5
                         SMD
                                         95%-CI
                                                   z p-value
Random effects model 0.2375 [-0.0491; 0.5242] 1.62 0.1043
Quantifying heterogeneity:
tau<sup>2</sup> = 0.0580; H = 1.53 [1.00; 2.52]; I<sup>2</sup> = 57.5% [0.0%; 84.2%]
Quantifying residual heterogeneity:
H = 1.63 [1.00; 2.81]; I^2 = 62.4\% [0.0\%; 87.4\%]
Test of heterogeneity:
    Q d.f. p-value
         4 0.0517
 9.41
Results for subgroups (random effects model):
                 SMD
                                 95%-CI
            k
                                           Q tau^2
                                                       I^2
RCT = no
            3 0.4571 [-0.1287; 1.0429] 7.13 0.1871 72.0%
RCT = yes
            2 0.0852 [-0.1353; 0.3057] 0.84
                                                   0 0.0%
Test for subgroup differences (random effects model):
                     Q d.f. p-value
                          1 0.2442
                 1.36
Between groups
Details on meta-analytical method:
- Inverse variance method
- DerSimonian-Laird estimator for tau<sup>2</sup>
- Hedges' g (bias corrected standardised mean difference)
```







# **5 IPSS Total Scores**

Robotic treatment (experimental group) compared to laproscopic treatment (control group). Results as mean differences and assuming a lower score to be better. Assuming that the data is assymtotically normal (especially symmetric) in the studies reporting median and range, mean and standard deviation are estimated.



Figure 11: Forest plot for meta-analysis of IPSS at latest time point available, sorted by time of measurement from earliest to latest

Number of studies combined: k = 7 MD 95%-CI z p-value Random effects model -0.7019 [-1.3081; -0.0957] -2.27 0.0232

Quantifying heterogeneity:



```
tau<sup>2</sup> = 0.0962; H = 1.08 [1.00; 1.99]; I<sup>2</sup> = 13.5% [0.0%; 74.7%]
Quantifying residual heterogeneity:
H = 1.13 [1.00; 1.71]; I^2 = 21.5\% [0.0\%; 65.9\%]
Test of heterogeneity:
    Q d.f. p-value
 6.94
         6 0.3268
Results for subgroups (random effects model):
                   MD
                                                tau^2
            k
                                   95%-CI
                                            Q
                                                        I^2
            5 -0.6020 [-1.1706; -0.0335] 1.08
RCT = no
                                                   0 0.0%
           2 -1.3733 [-4.1832; 1.4367] 5.29 3.3403 81.1%
RCT = yes
Test for subgroup differences (random effects model):
                     Q d.f. p-value
Between groups
                 0.28
                         1 0.5980
Details on meta-analytical method:
- Inverse variance method
- DerSimonian-Laird estimator for tau<sup>2</sup>
```



Figure 12: Funnel plot for meta-analysis of IPSS at latest time point available, sorted by time of measurement from earliest to latest



#### 6 Session Information

```
R version 3.5.1 (2018-07-02)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 10 x64 (build 17134)
Matrix products: default
locale:
[1] LC_COLLATE=German_Germany.1252 LC_CTYPE=German_Germany.1252
[3] LC_MONETARY=German_Germany.1252 LC_NUMERIC=C
[5] LC_TIME=German_Germany.1252
attached base packages:
[1] stats
             graphics grDevices utils
                                           datasets methods
                                                               base
other attached packages:
 [1] readxl_1.1.0
                    meta_4.9-2
                                    forcats_0.3.0
                                                    stringr_1.3.1
 [5] dplyr_0.8.0.1
                   purrr_0.2.5
                                    readr_1.1.1
                                                    tidyr_0.8.2
 [9] tibble_2.1.1
                    ggplot2_3.1.0
                                    tidyverse_1.2.1
loaded via a namespace (and not attached):
                                                       compiler_3.5.1
 [1] Rcpp_1.0.0
                     cellranger_1.1.0 pillar_1.3.1
 [5] plyr_1.8.4
                     tools_3.5.1
                                      digest_0.6.18
                                                       lubridate_1.7.4
 [9] jsonlite_1.5
                     evaluate_0.12
                                      nlme_3.1-137
                                                       gtable_0.2.0
[13] lattice_0.20-35 pkgconfig_2.0.2 rlang_0.3.4
                                                       cli_1.0.1
[17] rstudioapi_0.8
                     yaml_2.2.0
                                      haven_1.1.2
                                                       withr_2.1.2
[21] xml2_1.2.0
                     httr_1.3.1
                                      knitr_1.20
                                                       hms_0.4.2
                                                       tidyselect_0.2.5
[25] rprojroot_1.3-2 imbiReport_0.1.0 grid_3.5.1
[29] glue_1.3.0
                     R6_2.3.0
                                      rmarkdown_1.10
                                                      modelr_0.1.2
[33] magrittr_1.5
                     codetools_0.2-15 backports_1.1.2 scales_1.0.0
[37] htmltools_0.3.6 rvest_0.3.2
                                      assertthat_0.2.0 colorspace_1.3-2
[41] stringi_1.2.4
                     lazyeval_0.2.1 munsell_0.5.0
                                                       broom_0.5.0
[45] crayon_1.3.4
```