# Levator ani Avulsion Systematic Evidence Review (LASER)

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## Abstract

Background: There is variation in the reported incidence of levator avulsion (LA). Objective: Explore incidence of LA by mode of birth, imaging modality, timing of diagnosis and laterality of avulsion. Search strategy: We searched MEDLINE, EMBASE, CINAHL, AMED and MIDIRS with no language restriction from inception to April 2019. Study eligibility criteria: A study was included if LA was assessed by an imaging modality after the first vaginal birth or if only delivered by caesarean section. Case series and reports were not included. Data collection and analysis: RevMan v5.3 was used for the meta-analyses and SW SAS and STATISTICA packages for type and timing of imaging analyses. Results: We included 37 primary non-randomized studies from 17 countries and involving 5594 women. Incidence of LA was 1%, 15%, 21%, 38.5% and 52% following caesarean, spontaneous, vacuum, spatula and forceps births respectively, with no differences by imaging modality. OR of LA following spontaneous birth vs. caesarean was 10.69. While the OR for LA following vacuum and forceps compared to the spontaneous birth were 1.66 and 6.32 respectively. LA was more likely to occur on the right side following spontaneous birth (p = 0.02) and unilaterally vs. bilaterally following spontaneous (p < 0.001) and vacuum-assisted births (p = 0.0103) only. Incidence was higher if assessment was performed in the first 4 weeks postpartum. Conclusions: Forceps significantly increases incidence and severity of LA. Ultrasound and MRI are comparable diagnostic tools but early postpartum imaging may lead to over diagnosis of LA.

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Table 2 LASER final.pdf available at https://authorea.com/users/375213/articles/492532-levator-ani-avulsion-systematic-evidence-review-laser

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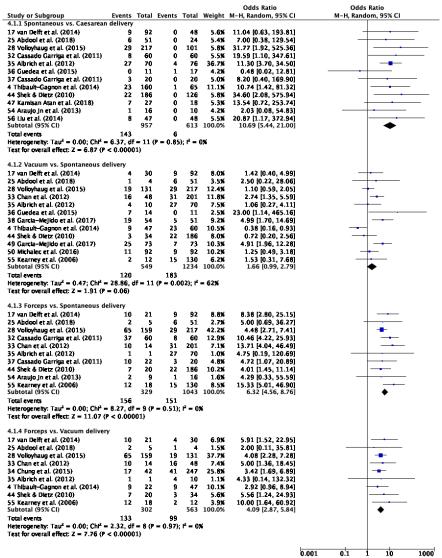
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Study or Subgroup	Incidence	SF	Total	Total	Weight	Incidence IV, Random, 95% CI	Incidence IV, Random, 95% CI
1.1.1 Caesarean section	meidence		Total	Total	Weight	IV, Random, 55% CI	14, Kulldolli, 55% Cl
54 Araujo Jn et al. (2013)	0	0.1574	10	0	0.1%	0.00 [-0.31, 0.31]	
10 Dietz & Lanzarone (2005)	0	0.1454	11	0	0.1%	0.00 [-0.28, 0.28]	
45 Valsky et al. (2009)	0	0.1112	15	0	0.2%	0.00 [-0.22, 0.22]	
25 Abdool et al. (2018)	0	0.102	24	0	0.3%	0.00 [-0.20, 0.20]	
47 Kamisan Atan et al. (2018)	0	0.0945	18 20	0	0.3%	0.00 [-0.19, 0.19]	
32 Cassado Garriga et al. (2011) 46 Araujo et al. (2018)	0.14285714	0.0859	21	0	0.4%	0.00 [-0.17, 0.17] 0.14 [-0.01, 0.29]	
57 Marsoosi et al. (2015)	0.142037.14	0.07	25	ő	0.6%	0.00 [-0.14, 0.14]	
29 Hellbrun et al. (2010)	ŏ	0.0609	29	ŏ	0.7%	0.00 [-0.12, 0.12]	
31 Novellas et al. (2010)	ŏ	0.059	30	ō	0.8%	0.00 [-0.12, 0.12]	
36 Guedea et al. (2015)	0.05882353	0.05706721	17	1	0.9%	0.06 [-0.05, 0.17]	<del> </del>
27 Brandon et al. (2012)	0.05	0.04873397	20	1	1.2%	0.05 [-0.05, 0.15]	<del> </del>
43 Volloyhaug et al. (2017)	0	0.0402	45	0	1.7%	0.00 [-0.08, 0.08]	
56 Llu et al. (2014)	0	0.0378	48	0	1.9%	0.00 [-0.07, 0.07]	Ŧ
17 van Delft et al. (2014) 37 Cassado Garriga et al. (2011)	0	0.0378 0.0304	46 60	0	1.9% 3.0%	0.00 [-0.07, 0.07]	T
35 Albrich et al. (2012)	0.05263158	0.02561391	76	4	4.2%	0.00 [-0.06, 0.06] 0.05 [0.00, 0.10]	-
52 Chan et al. (2014)	0.03203130	0.0242	76	ō	4.7%	0.00 [-0.05, 0.05]	+
28 Volloyhaug et al. (2015)	ŏ	0.0183	101	ŏ	8.3%	0.00 [-0.04, 0.04]	+
4 Thibault-Gagnon et al. (2014)	0.01538462		65	1	11.9%	0.02 [-0.01, 0.05]	+
44 Shek & Dietz (2010)	0	0.0147	126	0	12.8%	0.00 [-0.03, 0.03]	+
26 Caudwell-Hall et al. (2017)	0	0.008	235	0	43.4%	0.00 [-0.02, 0.02]	•
Subtotal (95% CI)			1120	10	100.0%	0.01 [-0.00, 0.02]	•
Heterogeneity: $Tau^2 = 0.00$ ; $Cht^2 = $ Test for overall effect: $Z = 1.11$ (P		(P = 0.98); P	- 0%				
1.1.2 Spontaneous delivery							
58 Shi et al. (2016)	0.4	0.1549	10	4	0.7%	0.40 [0.10, 0.70]	<del></del>
36 Guedea et al. (2015)	0	0.1454	11	0	0.8%	0.00 [-0.28, 0.28]	
47 Kamisan Atan et al. (2018)	0.2593	0.0843	27	7	2.1%	0.26 [0.09, 0.42]	J ——
37 Cassado Garriga et al. (2011)	0.15	0.0798	20	3	2.2%	0.15 [-0.01, 0.31]	
54 Araujo Jn et al. (2013) 35 Albrich et al. (2012)	0.0625 0.3857	0.0605 0.0582	16 70	1 21	3.2%	0.06 [-0.06, 0.18] 0.39 [0.27, 0.50]	
56 Llu et al. (2014)	0.1702	0.0548	47	- 6	3.6%	0.17 [0.06, 0.28]	<del></del>
48 Aydin et al. (2015)	0.369	0.0527	84	31	3.8%	0.37 [0.27, 0.47]	· ·
25 Abdool et al. (2018)	0.1176	0.0451	51	6	4.4%	0.12 [0.03, 0.21]	-
32 Cassado Garriga et al. (2011)	0.1333	0.0439	60	8	4.5%	0.13 [0.05, 0.22]	<del></del>
38 Garcia-Mejido et al. (2017)	0.098	0.0416	51	5	4.7%	0.10 [0.02, 0.18]	
51 Garcia-Mejido et al. (2016)	0.1216	0.038	74	9	5.1%	0.12 [0.05, 0.20]	<del></del>
49 Garcia-Mejido et al. (2017) 50 Michalec et al. (2016)	0.0959	0.0345 0.031	73 92	7	5.4% 5.8%	0.10 [0.03, 0.16]	
17 van Delft et al. (2014)	0.0978 0.0978	0.031	92	9	5.8%	0.10 [0.04, 0.16] 0.10 [0.04, 0.16]	
55 Kearney et al. (2006)	0.1154	0.028	130	15	6.1%	0.12 [0.06, 0.17]	-
4 Thibault-Gagnon et al. (2014)	0.1438	0.0277	160	23	6.1%	0.14 [0.09, 0.20]	-
33 Chan et al. (2012)	0.1542	0.0255	201	31	6.3%	0.15 [0.10, 0.20]	-
53 Youssef et al. (2019)	0.2137	0.0253	262	56	6.4%	0.21 [0.16, 0.26]	-
41 Cassado Garriga et al. (2014)	0.1289	0.0241	194	25	6.5%	0.13 [0.08, 0.18]	<del>-</del>
44 Shek & Dietz (2010)	0.1183	0.0237	186	22	6.5%	0.12 [0.07, 0.16]	-
28 Volkyhaug et al. (2015) Subtotal (95% CI)	0.1336	0.0231	217 2128	29 329	6.6% 100.0%	0.13 [0.09, 0.18] 0.15 [0.12, 0.18]	-
Heterogeneity: Tau <sup>2</sup> = 0.00; Cht <sup>2</sup> =		1 (P < 0.0000				,	'
Test for overall effect: Z = 10.63 (	P < 0.00001)						
1.1.3 Vacuum extraction	0.25	0.2155			1 5-2	0.25 [ 0.17 0.23	
25 Abdool et al. (2018)	0.25 0.4	0.2165	4	1	1.5%	0.25 [-0.17, 0.67]	
35 Albrich et al. (2012) 36 Guedea et al. (2015)	0.4	0.1549 0.1336	10 14	7	2.6% 3.3%	0.40 [0.10, 0.70] 0.50 [0.24, 0.76]	
55 Kearney et al. (2006)	0.1667	0.1076	12	2	4.5%	0.17 [-0.04, 0.38]	<del></del>
33 Chan et al. (2012)	0.333	0.068	48	16	7.6%	0.33 [0.20, 0.47]	
38 Garcia-Mejido et al. (2017)	0.3519	0.065	54	19	8.0%	0.35 [0.22, 0.48]	
17 van Delft et al. (2014)	0.1333	0.0621	30	4	8.3%	0.13 [0.01, 0.26]	<del></del>
4 Thibault-Gagnon et al. (2014)	0.1915	0.0574	47	9	8.8%	0.19 [0.08, 0.30]	<del></del>
49 Garcia-Mejido et al. (2017)	0.3425	0.0555	73 34	25 3	9.0%	0.34 [0.23, 0.45]	
44 Shek & Dietz (2010) 50 Michalec et al. (2016)	0.0882 0.1196	0.0486 0.0338	92	11	9.9% 11.7%	0.09 [-0.01, 0.18] 0.12 [0.05, 0.19]	<u> </u>
28 Volkoyhaug et al. (2015)	0.1196	0.0338	131	19	12.0%	0.14 [0.08, 0.21]	
34 Chung et al. (2015)	0.166	0.0237	247	41	12.6%	0.17 [0.12, 0.21]	-
Subtotal (95% CI)	J30	3.4-37	796		100.0%	0.21 [0.16, 0.27]	•
Heterogeneity: $Tau^2 = 0.01$ ; $Cht^2 = $ Test for overall effect: $Z = 7.64$ (P		2 (P = 0.0002)	; r² = 6	8%			
1.1.4 Forceps delivery							
35 Albrich et al. (2012)	1	0.4975	1	1	0.8%	1.00 [0.02, 1.98]	[
25 Abdool et al. (2018)		0.21908902	5	2	3.2%	0.40 [-0.03, 0.83]	<del></del>
54 Araujo Jn et al. (2013)	0.222	0.1385799	9	2	5.9%	0.22 [-0.05, 0.49]	+
33 Chan et al. (2012)	0.71428571	0.12073632	14	10	6.9%	0.71 [0.48, 0.95]	<del></del>
55 Kearney et al. (2006)		0.11111111	18	12	7.5%	0.67 [0.45, 0.88]	<del>-</del>
17 van Delft et al. (2014)		0.10898517	21	10	7.6%	0.48 [0.26, 0.69]	
44 Shek & Dietz (2010) 37 Cassado Garriga et al. (2011)		0.10665365 0.10615895	20 22	7 10	7.7% 7.8%	0.35 [0.14, 0.56] 0.45 [0.25, 0.66]	
4 Thibault-Gagnon et al. (2014)		0.10482356	22	9	7.9%	0.41 [0.20, 0.61]	
34 Chung et al. (2015)		0.07573917	42	17	9.9%	0.71 [0.57, 0.86]	
32 Cassado Garriga et al. (2011)	0.61666667	0.06276794	60	37	10.9%	0.62 [0.49, 0.74]	
40 Krofta et al. (2009)	0.63157895	0.05533237	76	48	11.5%	0.63 [0.52, 0.74]	
28 Volloyhaug et al. (2015)		0.03898746	159	65	12.6%	0.41 [0.33, 0.49]	<b>—</b>
Subtotal (95% CI)			469		100.0%	0.52 [0.44, 0.61]	•
Heterogeneity: Tau <sup>2</sup> = 0.01; Chi <sup>2</sup> =		z (P = 0.0004)	: r = 6	6%			[
Test for overall effect: Z = 11.78 (	r < 0.00001)						[
							de 0/25 A 0 45 0/5
							-0.5 -0.25 0 0.25 0.5



Test for subgroup differences:  $Chl^2 = 24.77$ , df = 3 (P < 0.0001),  $l^2 = 87.9\%$ 

