

Online supplement

Search strategies are presented in Table 1. Searches including hand searches cover a time period between January 1998 and March 31, 2020.

Table S1: Search strategy

Cochrane Library

Includes Cochrane Database of Systematic Reviews (CDSR), Database of Abstracts of Reviews of Effects (DARE), Cochrane Central Trials Register (CENTRAL), NHS Economic Evaluations Database (NHSEED), Health Technology Assessment Database (HTAD)

Search Strategy:

#1 MeSH descriptor: [Electric Stimulation Therapy] this term only

#2 ((sacral or bilateral or unilateral) near/3 (modul\$* or stimul* or neuromodul* or neurostimul* or electromodul* or electrostimul*)):ti,ab

#3 (sns or snm):ti,ab

#4 #1 or #2 or #3

#5 MeSH descriptor: [Urinary Incontinence] explode all trees

#6 ((urine or urinary) near/1 incontinen*):ti,ab

#7 MeSH descriptor: [Lower Urinary Tract Symptoms] explode all trees

#8 (lower urinary tract near/1 (dysfunction* or symptom*)):ti,ab

#9 MeSH descriptor: [Urinary Bladder, Neurogenic] this term only

#10 ((neurogenic or neurogenesis or neuropathic or spastic) near/2 bladder):ti,ab

#11 MeSH descriptor: [Urinary Retention] this term only

#12 ((urin* near/1 retention) or ischuria):ti,ab

#13 voiding dysfunction:ti,ab

#14 #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13

#15 MeSH descriptor: [Multiple Sclerosis] this term only

#16 multiple sclerosis:ti,ab

#17 MeSH descriptor: [Spinal Cord Injuries] this term only

#18 (spinal cord near/1 (injur* or trauma* or damag*)):ti,ab

#19 MeSH descriptor: [Cerebrovascular Disorders] explode all trees

#20 ((cerebrovascular or "cerebral vascular") near/1 (disease\$* or disorder*)):ti,ab

#21 MeSH descriptor: [Parkinson Disease] this term only

#22 parkinson*:ti,ab

#23 MeSH descriptor: [Alzheimer Disease] this term only

#24 alzheimer*:ti,ab

#25 MeSH descriptor: [Reflex, Abnormal] this term only

#26 (detrusor near/2 (sphincter or dyssynergia or hyperreflexia or overactiv*)):ti,ab

#27 (neurogenic or neurogenesis or neuropathic or neurologic*):ti,ab

#28 MeSH descriptor: [Diabetes Mellitus] explode all trees

#29 diabet*:ti,ab

#30 ((neurologic\$* or nerve or pelvic plexus) near/2 (injur* or trauma* or damag*)):ti,ab

#31 MeSH descriptor: [Nervous System Diseases] this term only and with qualifier(s): [Complications - CO]

#32 MeSH descriptor: [Spinal Dysraphism] explode all trees

#33 ((spine or spina*) near/2 (dysraphi* or bifida)):ti,ab

#34 MeSH descriptor: [Meningomyelocele] this term only

#35 (MMC or myelomeningocele* or meningomyelocele* or myelocystocele* or myelomeningocaele* or meningomyelocaele* or myelocystocaele*):ti,ab

#36 ((sacral or sacrum) near/2 malform*):ti,ab

#37 #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 #38 #4 and #14 and #37

Medline

Searched via OvidSP interface.

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

Search Strategy:

- 1 Electric Stimulation Therapy/
- 2 ((sacral or bilateral or unilateral) adj3 (modul\$ or stimul\$ or neuromodul\$ or neurostimul\$ or electromodul\$ or electrostimul\$)).ti,ab.
- 3 (sns or snm).ti,ab.
- 4 or/1-3
- 5 exp Urinary Incontinence/

- 6 ((urine or urinary) adj1 incontinen\$).ti,ab.
- 7 exp Lower Urinary Tract Symptoms/
- 8 (lower urinary tract adj1 (dysfunction\$ or symptom\$)).ti,ab.
- 9 Urinary Bladder, Neurogenic/
- 10 ((neurogenic or neurogenesis or neuropathic or spastic) adj2 bladder).ti,ab.
- 11 Urinary Retention/
- 12 ((urin\$ adj1 retention) or ischuria).ti,ab.
- 13 voiding dysfunction.ti,ab.
- 14 or/5-13
- 15 multiple sclerosis/ or multiple sclerosis.ti,ab.
- 16 spinal cord injuries/ or (spinal cord adj1 (injur\$ or trauma\$ or damag\$)).ti,ab.
- 17 exp Cerebrovascular Disorders/ or ((cerebrovascular or "cerebral vascular") adj1 (disease\$ or disorder\$)).ti,ab.
- 18 Parkinson disease/ or parkinson\$.ti,ab.
- 19 Alzheimer disease/ or alzheimer\$.ti,ab.
- 20 Reflex, Abnormal/ or (detrusor adj2 (sphincter or dyssynergia or hyperreflexia or overactiv\$)).ti,ab.
- 21 (neurogenic or neurogenesis or neuropathic or neurologic\$).ti,ab.
- 22 exp Diabetes Mellitus/ or diabet\$.ti,ab.
- 23 ((neurologic\$ or nerve or pelvic plexus) adj2 (injur\$ or trauma\$ or damag\$)).ti,ab.
- 24 Nervous System Diseases/co [Complications]
- 25 exp Spinal Dysraphism/
- 26 ((spine or spina\$) adj2 (dysraphi\$ or bifida)).ti,ab.
- 27 Meningomyelocele/
- 28 (MMC or myelomeningoc?ele\$ or meningomyeloc?ele\$ or myelocystoc?ele\$).ti,ab.
- 29 ((sacral or sacrum) adj2 malform\$).ti,ab.
- 30 or/15-29 (1311965)
- 31 4 and 14 and 30

Embase

Searched via OvidSP interface.

Database: Embase <1974 to present >

Search Strategy:

- 1 Sacral nerve stimulation/
- 2 ((sacral or bilateral or unilateral) adj3 (modul\$ or stimul\$ or neuromodul\$ or neurostimul\$ or electromodul\$ or electrostimul\$)).ti,ab.
- 3 (sns or snm).ti,ab.
- 4 or/1-3
- 5 exp urine incontinence/
- 6 ((urine or urinary) adj1 incontinen\$).ti,ab.
- 7 exp lower urinary tract symptom/
- 8 (lower urinary tract adj1 (dysfunction\$ or symptom\$)).ti,ab.
- 9 voiding dysfunction.ti,ab.
- 10 neurogenic bladder/
- 11 ((neurogenic or neurogenesis or neuropathic or spastic) adj2 bladder).ti,ab.
- 12 urine retention/
- 13 ((urin\$ adj1 retention) or ischuria).ti,ab.
- 14 or/5-13
- 15 multiple sclerosis/ or multiple sclerosis.ti,ab.
- 16 spinal cord injury/ or (spinal cord adj1 (injur\$ or trauma\$ or damag\$)).ti,ab.
- 17 exp cerebrovascular disease/ or ((cerebrovascular or "cerebral vascular") adj1 (disease\$ or disorder\$)).ti,ab.
- 18 Parkinson disease/ or parkinson\$.ti,ab.
- 19 Alzheimer disease/ or alzheimer\$.ti,ab.
- 20 hyperreflexia/ or detrusor dyssynergia/ or (detrusor adj2 (sphincter or dyssynergia or hyperreflexia or overactiv\$)).ti,ab.
- 21 (neurogenic or neurogenesis or neuropathic).ti,ab.
- 22 exp Diabetes Mellitus/ or diabet\$.ti,ab.
- 23 nerve injury/ or ((neurologic\$ or nerve or pelvic plexus) adj2 (injur\$ or trauma\$ or damag\$)).ti,ab.
- 24 neurologic disease/co [Complication]

- 25 exp spinal dysraphism/ (10053)
- 26 ((spine or spina\$) adj2 (dysraphi\$ or bifida)).ti,ab.
- 27 myelomeningocele/
- 28 (MMC or myelomeningoc?ele\$ or meningomyeloc?ele\$ or myelocystoc?ele\$).ti,ab.
- 29 ((sacral or sacrum) adj2 malform\$).ti,ab.
- 30 or/15-29
- 31 4 and 14 and 30

ClinicalTrials.gov

Searched via <https://clinicaltrials.gov>

In Advanced Search/Targeted search terms entered into Condition field and Intervention field.
No other limits applied. Three searches run as intervention terms too long for single search;

Search #1

In Condition field;

((urine OR urinary OR urine OR urinary OR voiding) AND (incontinence OR incontinent OR retention OR dysfunction OR disfunction)) OR ischuria OR ((neurogenic or neurogenesis or neuropathic or spastic) AND bladder)

In Intervention field;

SNM OR SNS OR "sacral neuromodulation" OR "sacral neurostimulation" OR "sacral neuroelectromodulation" OR "sacral neuroelectrostimulation" OR "sacral nerve modulation" OR "sacral nerve stimulation"

Search #2

In Condition field;

((urine OR urinary OR urine OR urinary OR voiding) AND (incontinence OR incontinent OR retention OR dysfunction OR disfunction)) OR ischuria OR ((neurogenic or neurogenesis or neuropathic or spastic) AND bladder)

In Intervention field;

"sacral nerve electromodulation" OR "sacral nerve electrostimulation" OR "sacral nerve electromodulation" OR "bilateral neuromodulation" OR "bilateral neurostimulation" OR "bilateral neuroelectromodulation" OR "bilateral neuroelectrostimulation"

Search #3

In Condition field;

((urine OR urinary OR urine OR urinary OR voiding) AND (incontinence OR incontinent OR retention OR

dysfunction OR disfunction)) OR ischuria OR ((neurogenic or neurogenesis or neuropathic or spastic) AND bladder)

In Intervention field;

"bilateral nerve modulation" OR "bilateral nerve stimulation" OR "bilateral nerve electromodulation" OR "bilateral nerve electrostimulation" OR "bilateral nerve electromodulation"

WHO ICTRP

Searched via <http://apps.who.int/trialsearch/AdvSearch.aspx>

Search #1

In Condition field;

((urine OR urinary OR urine OR urinary OR voiding) AND (incontinence OR incontinent OR retention OR dysfunction OR disfunction)) OR ischuria OR ((neurogenic or neurogenesis or neuropathic or spastic) AND bladder)

In Intervention field;

SNM OR SNS OR "sacral neuromodulation" OR "sacral neurostimulation" OR "sacral neuroelectromodulation" OR "sacral neuroelectrostimulation" OR "sacral nerve modulation" OR "sacral nerve stimulation"

Search #2

In Condition field;

((urine OR urinary OR urine OR urinary OR voiding) AND (incontinence OR incontinent OR retention OR dysfunction OR disfunction)) OR ischuria OR ((neurogenic or neurogenesis or neuropathic or spastic) AND bladder)

In Intervention field;

"sacral nerve electromodulation" OR "sacral nerve electrostimulation" OR "sacral nerve electromodulation" OR "bilateral neuromodulation" OR "bilateral neurostimulation" OR "bilateral neuroelectromodulation" OR "bilateral neuroelectrostimulation"

Search #3

In Condition field;

((urine OR urinary OR urine OR urinary OR voiding) AND (incontinence OR incontinent OR retention OR dysfunction OR disfunction)) OR ischuria OR ((neurogenic or neurogenesis or neuropathic or spastic) AND bladder)

In Intervention field;

"bilateral nerve modulation" OR "bilateral nerve stimulation" OR "bilateral nerve electromodulation" OR "bilateral nerve electrostimulation" OR "bilateral nerve electromodulation"

Table S2. Publication bias and reporting quality of success rates of included studies for permanent SNM

Author [year]	N	Parameter for success rate	Funding support by manufacturer?
Al-Azzawi et al. [2018]	4	≥50% improvement	None
Amundsen et al. [2005]	23	cured	NR
Andretta et al. [2014]	17	significant and lasting improvement + QoL + active implant	NR
Arlen et al. [2011]	20	≥50% improvement	NR
Bertapelle et al. [2008]	12	Cure or improved voiding (1-2 catheterizations/d)	NR
Carone et al. [1999]	12	Positive or intermediate patient outcome	NR
Chaabane et al. [2011]	37	≥50% improvement*	None
Chartier-Kastler et al. [2000]	9	≥75% improvement	None
Chen et al. [2015]	13	≥50% improvement + no therapy failure	None
Daniels et al. [2010]	24	Non-explant / non-therapy failure	None
Denzinger et al. [2012]	7	≥50% improvement / active implant	NA
Engeler et al. [2015]	16	≥70% improvement / subjective success	None
Hohenfellner et al. [1998]	11	≥50% improvement	NR
Hohenfellner et al. [2001]	12	≥50% improvement + active implant	NR
Ishigooka et al. [1998]	4	urodynamic + subjective improvement	NR
Lavano 2004	6	≥50% improvement	NR
Lombardi [2014]	34	≥50% improvement	None
Marinkovic et al. [2010]	12	≥50% improvement	NR
Minardi et al. 2012]	15	≥50% improvement + active implant	None
Peters et al. [2013]	63	Non-explants	None
Sharifiaghdas [2019]	4	≥50% improvement	None
Sievert et al. [2010]	10	No leakage / active implant	Yes
Wallace et al. [2007]	28	Patient satisfaction / non-explants	NR
Wöllner et al. [2016]	35	≥50% improvement / patient satisfaction	None

NR: not reported

NA: information not available

*both clinical and urodynamic improvement

Figure S1A. Additional meta-analysis of the test success rate of SNM (Forest plot including studies with ≥ 10 patients)

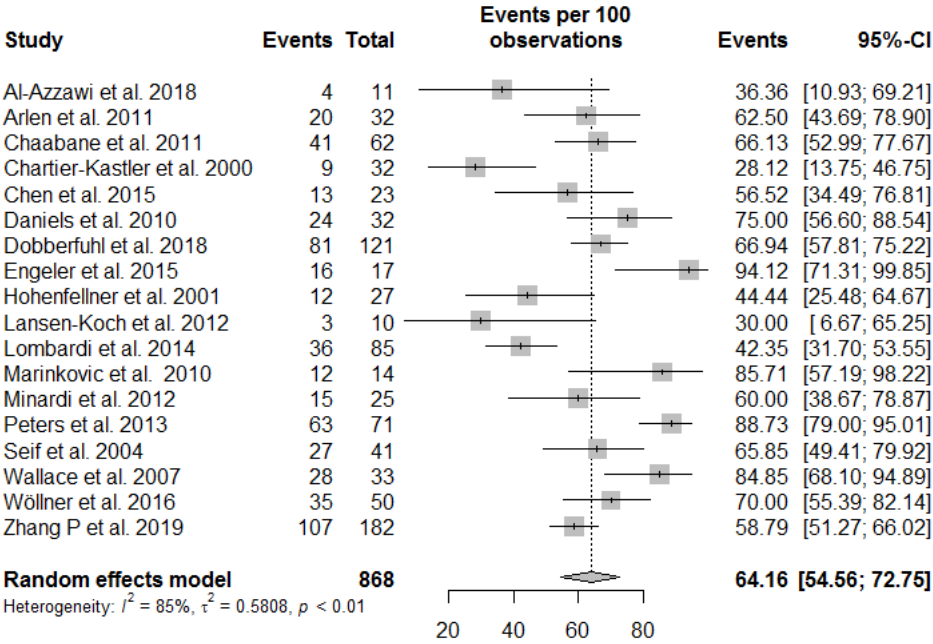
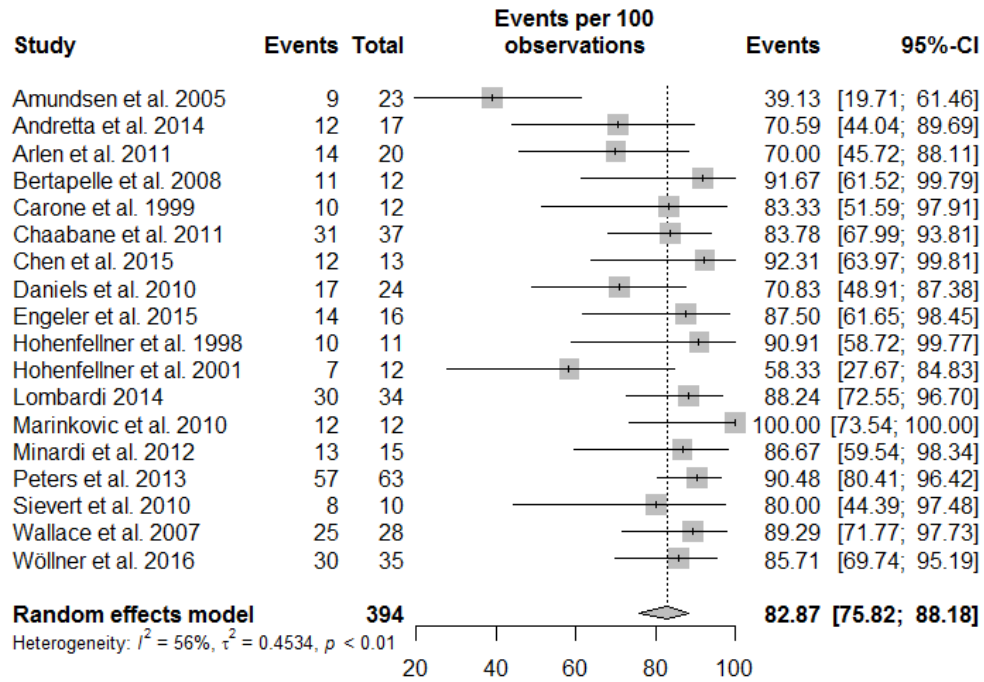


Figure S1B. Additional meta-analysis of the SNM success rate of the permanent implant (Forest plot including studies with ≥ 10 patients)



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