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Spinal Cord Stimulation for Neuropathic Pain in England From 2010 to 2020: A Hospital Episode Statistics Analysis

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ABSTRACT

Objectives: Spinal cord stimulation (SCS) is a recognized intervention for the management of chronic neuropathic pain. The United Kingdom National Institute of Health and Care Excellence has recommended SCS as a management option for chronic neuropathic pain since 2008. The aim of this study is to undertake an assessment of SCS uptake across the National Health Service in England up to 2020.

Materials and Methods: Hospital Episode Statistics were obtained for patients with neuropathic pain potentially eligible for SCS and patients receiving an SCS–related procedure. Data were retrieved nationally and per region from the years 2010–2011 to 2019–2020.

Results: There were 50,288 adults in England attending secondary care with neuropathic pain in 2010–2011, increasing to 66,376 in 2019–2020. The number of patients with neuropathic pain with an SCS procedure increased on a year-to-year basis until 2018–2019. However, less than 1% of people with neuropathic pain received an SCS device with no evidence of an increase over time when considering the background increase in neuropathic pain prevalence.

Conclusion: Only a small proportion of patients in England with neuropathic pain potentially eligible for SCS receives this intervention. The recommendation for routine use of SCS for management of neuropathic pain has not resulted in an uptake of SCS over the last decade.

Keywords: Cohort study, hospital episode statistics data base, intervention uptake, neuropathic pain, spinal cord stimulation

Conflict of Interest: Rui V. Duarte has received consultancy fees from Boston Scientific Corp, Mainstay Medical, Medtronic Ltd, and Saluda Medical. Rod S. Taylor has received consultancy fees from Medtronic Ltd, Nevro Corp, and Saluda Medical. Sam Eldabe has received consultancy fees from Abbott, Boston Scientific Corp, Mainstay Medical, and Medtronic Ltd. He has received Department Research funding from the National Institute of Health Research, Medtronic Ltd, and Nevro Corp. The other authors reported no conflict of interest.

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INTRODUCTION

Pain and pain-related conditions are recognized as prominent causes of disability worldwide by the Global Burden of Disease Studies.[1] Chronic neuropathic pain is estimated to affect approximately 7% to 9% of the general population.[2–4] Some 5000 new cases of neuropathic pain as a consequence of persistent spinal pain syndrome (PSPS) occur in the United Kingdom each year, costing the United Kingdom National Health Service (NHS) in excess of £7 million annually.[5] Approximately 50% of patients with neuropathic pain fail to obtain pain relief from painkillers.[6] Growing awareness of the addictive potential of opioids[7] and gabapentinoids[8] has left an increasing number of patients with neuropathic pain with few safe or effective therapeutic options.

Spinal cord stimulation (SCS) is a recognized intervention for the management of chronic neuropathic pain. The clinical effectiveness of SCS for neuropathic pain is supported by a number of randomized controlled trials.[9–16] In addition, economic evaluations have consistently shown SCS to be a cost-effective intervention.[17–22] Based on this evidence, in 2008, the United Kingdom National Institute of Health and Care Excellence (NICE) recommended SCS for routine use as an effective and cost-effective treatment for severe refractory neuropathic pain.[23]

An analysis of United Kingdom Hospital Episode Statistics (HES) until 2012 showed no increase in the number of SCS device implantation since the NICE recommendation.[24] The aim of this study is to undertake a contemporary assessment of SCS uptake across the NHS in England up to 2020.

MATERIALS AND METHODS

This retrospective cohort study uses data from the United Kingdom HES database obtained through NHS Digital. HES is a publicly available data warehouse containing details of all admissions, outpatient appointments, and accident and emergency attendances at NHS hospitals in England.[25] Ethical approval was not required because the project does not involve human participants, human tissue, or identifiable personal data (University of Liverpool Research Integrity and Ethics, reference 8719).

Patient Selection

Several patients with neuropathic pain potentially eligible for SCS were identified using one or more International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) diagnosis codes that could refer to a neuropathic pain condition, recorded as the primary diagnosis (Table 1). Patients receiving an SCS–related procedure were derived using the Office of Population Censuses and Surveys (OPCS-4) codes for interventional procedures. OPCS-4 code A48.3 was assumed to reflect new permanent SCS implants; OPCS-4 code A48.4 to denote both replacements and revisions; and OPCS-4 code A48.7 to represent trial procedures.

Time Horizon and Regions

The time horizon for the analysis is ten years and based on the United Kingdom NHS financial year (ie, April–March). A start year of 2010–2011 was chosen because the recommendation for the use of SCS for management of chronic neuropathic pain was made by NICE[23] in 2008, and Clinical Commissioning Group (CCG) and CCG regions are not recorded in HES before the start year of 2010–2011.

Table 1. Codes Used to Retrieve HES Data.

OPCS-4 codes	
A48.3	Implantation of neurostimulator adjacent to the spinal cord
A48.4	Attention to neurostimulator adjacent to the spinal cord
A48.7	Insertion of neurostimulator electrodes into the spinal cord
ICD-10 codes	
M96.1	Postlaminectomy syndrome, not elsewhere classified
M89.0	Algoneurodystrophy, unspecified site
M89.01	Algoneurodystrophy, shoulder
M89.02	Algoneurodystrophy, upper arm
R52	Pain, unspecified
G56.4	Causalgia of upper limb (complex regional pain syndrome II of upper limb)
G57.7	Causalgia of lower limb (complex regional pain syndrome II of lower limb)
E10.4	Type 1 diabetes mellitus with neurological complications
E11.4	Type 2 diabetes mellitus with neurological complications
M79.6	Pain in limb, hand, foot, fingers, and toes
M54.1	Radiculopathy
M50.1	Cervical disc disorder with radiculopathy

Data were retrieved nationally (ie, England) and subnationally (ie, per region). The subnational figures were broken down using current CCG region areas. Before 2019–2020, there were fewer regions than there are currently, so pre-2019–2020 activity was mapped to 2019–2020 commissioning regions.

Data Analysis

We present frequency and proportions of patients with neuropathic pain (according to ICD-10 diagnosis codes) who received an SCS–related procedure (according to each separate OPCS-4 code) and who did not receive an SCS–related procedure. Data are presented for England, and for each Commissioning Region, each year from 2010 and 2020 was calculated.

Results are presented in tables and graphically; the graphs were prepared in Stata (version 14; StataCorp LLC, College Station, TX).

RESULTS

There were 50,288 adults in England attending secondary care with neuropathic pain in 2010–2011, increasing to 66,376 in 2019–2020 (Table 2). The number of patients with neuropathic pain with an SCS procedure increased on a year-to-year basis until 2018–2019 (Table 2; Fig. 1). Notably, there was a reduction in the number of patients who received a new permanent implant of an SCS device (represented by an OPCS-4 code A48) for the year 2019–2020. Despite a more than twofold increase in the number of new SCS implants being performed between 2010–2011 and 2019–2020, nationally, less than 1% of people with neuropathic pain received an SCS device, with limited evidence of an increase in this proportion over time. Interestingly, since 2014–2015, the number of SCS screening trials (represented by OPCS-4 code A48.7) has been consistently lower than the number of new implants. This may suggest an increase in the use of on-table trials instead of a two-stage procedure of SCS screening trial followed by implantation.

Some variability across regions has been observed (Supplementary Data Table S1). There was an increase of 133% in new SCS implants from 2010–2011 to 2019–2020. Nevertheless, these estimates remain <1.4% of the regional estimates of eligible patients

Table 2. National Estimates of Patients With Neuropathic Pain With and Without an SCS Procedure.

England	2010–2011	2011–2012	2012–2013	2013–2014	2014–2015	2015–2016	2016–2017	2017–2018	2018–2019	2019–2020	Δ 2010–2011 to 2019–2020, %
Total patients with neuropathic pain*	50,288	50,019	48,202	51,210	53,387	55,269	59,740	61,125	66,064	66,376	31.9%
Patients with neuropathic pain without an SCS procedure, n (%)†	49,705 (98.8%)	49,491 (98.9%)	47,549 (98.6%)	50,507 (98.6%)	52,584 (98.5%)	54,428 (98.5%)	58,846 (98.5%)	60,245 (98.6%)	65,054 (98.5%)	65,400 (98.5%)	31.6%
Patients with neuropathic pain with an SCS procedure, n (%)†											
Implantation of neurostimulator adjacent to the spinal cord (OPCS-4 code A48.3)	247 (0.5%)	234 (0.5%)	329 (0.7%)	385 (0.8%)	462 (0.9%)	510 (0.9%)	514 (0.9%)	551 (0.9%)	621 (0.9%)	576 (0.9%)	133.2%
Attention to neurostimulator adjacent to the spinal cord (OPCS-4 code A48.4)	176 (0.3%)	155 (0.3%)	163 (0.3%)	202 (0.4%)	220 (0.4%)	219 (0.4%)	233 (0.4%)	269 (0.4%)	291 (0.4%)	297 (0.4%)	68.8%
Insertion of neurostimulator electrodes into the spinal cord (OPCS-4 code A48.7)	210 (0.4%)	271 (0.5%)	376 (0.8%)	387 (0.8%)	402 (0.8%)	455 (0.8%)	483 (0.8%)	447 (0.7%)	497 (0.8%)	483 (0.7%)	130.0%

*One or more of the following ICD-10 diagnosis codes recorded as the primary diagnosis: M96.1, M89.0, M89.01, M89.02, R52, G56.4, G57.7, E10.4, E11.4, M79.6, M54.1, and M50.1.
†Counts sum to greater than the total number of patients with neuropathic pain and percentages sum to >100% where patients have had more than one type of SCS procedure within the year.

with neuropathic pain. Conversely, rates as low as 0.1% were observed in the Midlands. Increase in uptake of new implants from 2010–2011 to 2019–2020 was observed in London, North East and Yorkshire, North West, and South East (Supplementary Data Fig. S1). In the South West region, the rates of SCS implants reached a high of 1.9% of potentially eligible patients with neuropathic pain who received an SCS implant in 2015–2016, which decreased to 0.9% in 2019–2020. The disparity between SCS procedures conducted since 2010–2011 to 2019–2020 and the potential number of people with neuropathic pain is presented in Figure 2.

DISCUSSION

Our results show that only a minority of patients with neuropathic pain are considered for SCS in England. Although there was some regional variation, the overall proportion of patients with neuropathic pain receiving an SCS was <2% of those with neuropathic pain in the period 2010–2020. Although the absolute number of new permanent SCS implants has increased over the years, given the background increase in neuropathic pain prevalence, this does not represent an improvement in uptake. The proportion of patients with neuropathic pain with a new SCS implant has remained constant at 0.9% of the total patients with neuropathic pain since 2014–2015.

The United Kingdom prevalence rates of neuropathic pain observed in this study are lower than the 7% to 9% previously reported.[2–4] The HES database only records data on patients referred for treatment in secondary care and does not capture people who may have pain with neuropathic features managed in primary care for several years before referral to specialist treatment. However, in this study, we focused only on primary diagnosis associated with neuropathies to present an estimate of people with neuropathic pain who may be suitable to receive an SCS implant. Not all patients with neuropathic pain (ie, the 7%–9% of the population) may be eligible for SCS.

A previous report suggested that there was no evidence of an uptake of SCS in England until 2012.[24] However, the number of new SCS implants reported was higher (>500 for 2010–2011 and 2011–2012) than those observed in this study. In the Vyawahare et al[24] study, indications representing other targets for neurostimulation that may have been miscoded as SCS, such as sacral nerve stimulation for bladder and bowel dysfunction codes, were removed. However, it is likely that the figures reported included patients with nonneuropathic indications. Importantly, both the results of Vyawahare et al[24] and this study show that the NICE recommendation of the use of SCS has not resulted in improved access to this intervention in England.

We observed a reduction across SCS implant figures in 2019–2020, which suggests a general slowing of activity across SCS procedures. Because of the coronavirus disease 2019 pandemic pressures, the United Kingdom Department of Health and Social Care instructed NHS hospitals on March 17, 2020 to postpone all nonurgent elective operations from April 15, 2020 at the latest for a period of at least three months.[26] It is therefore likely that several hospitals had reduced elective pain activity before these instructions as a part of pain staff repurposing efforts, bringing down the national and most of the regional figures.

The low number of SCS implants per year and low uptake over the years may be explained by a potential lack of awareness of SCS current guidelines and consequent low referral rates for this

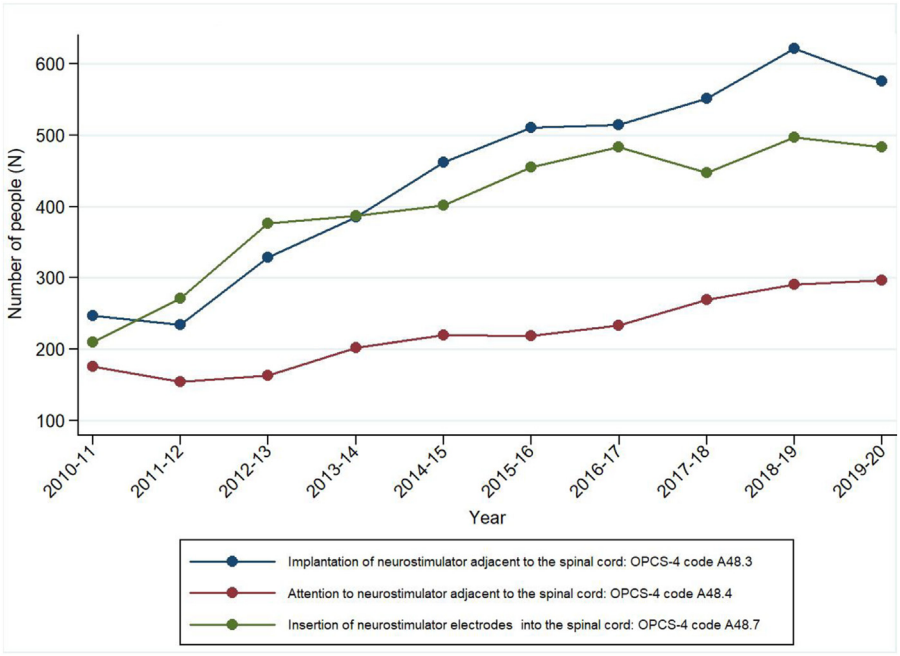

Figure 1. Patients with neuropathic pain with an SCS procedure (England). [Color figure can be viewed at www.neuromodulationjournal.org]

intervention. It is unlikely that the low number of SCS implants is caused by patients not being suitable candidates for SCS, given the recent estimates of 5000 new cases of neuropathic pain as a consequence of PSPS each year in the United Kingdom.[5] Despite the requirement to provide SCS in England following NICE's guidance,[23] funding limits across CCGs may have prevented an increase in capacity of implanting centers or even closure of other centers. Although the low figures for the Midlands can be explained by the closure of the Dudley Neuromodulation center and activity being moved to the Oxford and Liverpool areas, inequity in access to SCS across regions is evident. Inequity in access to SCS was previously suggested,[24] but no improvements seem to have occurred since. Further research into inequity and reasons for inequity in access to SCS across England is warranted.

It has previously been estimated that 27,484 SCS implants were performed in the United States in 2007.[27] A recent report identified 10,762 SCS procedures performed in the state of Florida, United States during 2018.[28] Of these, 8983 SCS procedures were an implantation or revision. In Denmark, 82 SCS implants were performed between January 2014 and May 2015,[29] whereas in

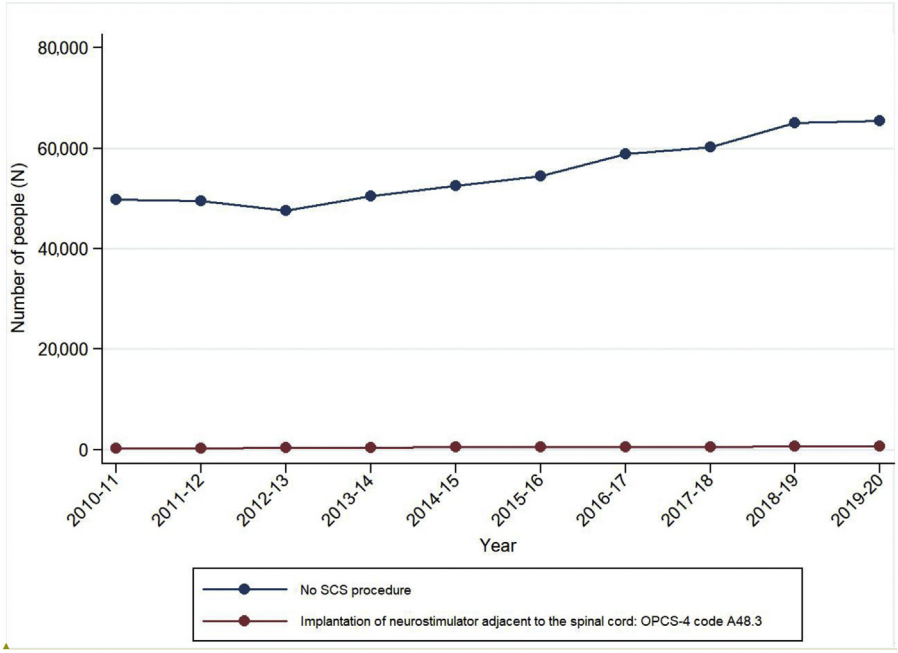

Figure 2. Patients with neuropathic pain with and without an SCS implant (England). [Color figure can be viewed at www.neuromodulationjournal.org]

Belgium, it is estimated that the number of SCS systems implanted per year has grown from around 650 in 2002 to approximately 900 in 2009.[30] A previous study indicated that the rate of SCS implants in England up to the year 2011 was lower than that observed in Belgium, France, The Netherlands, and Germany.[24] Interpretation of these rates when considering the data presented in this study is challenging because the SCS procedures reported in the studies conducted in other countries are not specific to neuropathic pain and do not evaluate the change in rates over the years or the disparity between the number of patients with neuropathic pain potentially suitable for SCS and those who receive an SCS implant.

Strengths and Limitations

This study used HES statistics, and we sought to apply methods that are transparent and reproducible. However, the estimates of patients with neuropathic pain potentially eligible for an SCS may be an underestimate because HES only records data from patients attending secondary care. In addition, the ICD-10 diagnosis codes used may not capture the full extent of the PSPS population. Although the inclusion of additional codes could result in an increase in the number of patients receiving an SCS implant, an analogous increase would be expected in the number of patients not receiving an SCS implant, with proportions reported remaining similar. The use of SCS over the years by indication could provide useful information; however, our aim was to look at SCS for all neuropathic pain rather than by indication. Although NICE TA159[23] was published in 2009, we only retrieved data from 2010–2011 because CCGs and CCG regions are not recorded in HES before this year, so it is not possible to provide a regional breakdown before 2010–2011.

CONCLUSION

Only a small proportion of patients in England with neuropathic pain potentially eligible for SCS receives this intervention, and NICE guidance published in 2008 has not affected the uptake of SCS over the last decade. There is regional variation in access to SCS, suggesting inequity in access. Further research is required to investigate possible reasons and mitigate inequalities in access to SCS.

Authorship Statements

Rui V. Duarte, Sarah Nevitt, Rachel Houten, Morag Brookes, Jill Bell, Jenny Earle, Rod S. Taylor, and Sam Eldabe were responsible for the original proposal and securing funding for the project. Rui V. Duarte and Sarah Nevitt acquired the aggregate data. Sarah Nevitt conducted the analysis of the data. Rui V. Duarte, Sarah Nevitt, and Sam Eldabe interpreted the data. Rui V. Duarte, Sarah Nevitt, and Sam Eldabe wrote the first draft of the manuscript. All authors contributed to and approved the final version of the manuscript.

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SUPPLEMENTARY DATA

To access the supplementary material accompanying this article, visit the online version of *Neuromodulation: Technology at the Neural Interface* at www.neuromodulationjournal.org and at https://doi.org/10.1016/j.neurom.2022.02.229.

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COMMENT

Duarte et al have comprehensively shown that spinal cord stimulation rates in the United Kingdom remain locked at/below 0.9% since 2012 despite major advances in the neuromodulation field of efficacy and reliability. This is not surprising, but it certainly is saddening in terms of patient access and equity of access in health care delivery. Given that the codes they used were very strict pure neuropathic conditions, it likely does not include a swathe of neuropathic pain postsurgery patients from different causes. The real figure in the denominator is likely to be much larger, and thus, the real implant rates for eligible patients are much lower. Although it is a subjective matter, I think most of us who work in the field would recognize that implant rates of 0.1% to 0.8% does not reflect the full group of patients who could benefit. I would posit conservatively that the true figure may be four to six times higher, which would mean that access is occurring for only 20% of the refractory neuropathic pain cohort seeking secondary care. How then do we increase equity of access? Firstly, by conducting further research that dives down into the components that are producing the inequity. Secondly, by bringing this to the attention of the funders/payers (in this case the NHS) and showing the glaring difference between the NICE guidelines and the outcomes on the ground. Thirdly, by both streamlining referral patterns and referrer knowledge and additionally ensuring that there is service delivery capacity in the neuromodulation centers of excellence. It is a whole of problem approach that needs to be taken here and I am sure the United Kingdom implanting community is acutely aware of these issues. It is only when we apply the spotlight to these problems and state what is and what is not acceptable medical care that we can change entrenched attitudes and inertia. I commend the authors for having exactly done so.

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