Usefulness of the STarT Back Screening Tool to predict pain problems after lumbar spine surgery

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ABSTRACT

INTRODUCTION: The Subgroups for Targeted Treatment (STarT) Back Screening Tool is used in general practice to stratify patients with acute back pain into either a low, medium or a high risk of developing complex pain. This study determines if the STarT Back Screening Tool can identify patients who are at a high risk of developing complex pain after spine surgery.

METHODS: The STarT Back Screening Tool was administered pre-operatively to a consecutive series of patients who had lumbar spine surgery between 29 October 2012 and 1 February 2013. A visual analogue scale (VAS, 0-100) for back and leg pain was determined pre-operatively and also on the first day after surgery, at discharge, at 4 to 12 weeks after surgery, and one year after surgery. Patients were stratified into those who underwent decompression only for lumbar disc herniation or stenosis and those who underwent decompression and fusion for spondylolisthesis.

RESULTS: In the decompression group, high-risk patients had poorer pre-operative back and leg pain scores, but similar length of stay, improvements in back or leg pain at 4-12 week and at the one-year follow-up compared with the other groups. The high-risk group experienced a significantly greater improvement in leg pain on the first post-operative day and on the day of discharge. In the decompression and fusion group, high-risk patients had poorer pre-operative back and leg pain scores than the other groups. There were no significant differences in back or leg pain improvement among the three groups at any time point during follow-up.

CONCLUSIONS: The results of this study show that the STarT Back Screening Tool may be useful for identifying patients who are at a high risk of developing complex pain after spine surgery.

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The Centre for Spine Surgery and Research in the Region of Southern Denmark performs 1,400 spine surgeries a year. These elective surgeries are for disc herniation, spinal stenosis and spondylolisthesis. Most of the patients have chronic pain, defined as pain that has lasted for more than 3-6 months [1] before they undergo surgery. Post-operatively, most patients can be sufficiently treated with analgesic medication [2]. However, some patients experience severe pain after spine surgery; do not respond to standard pain treatment regimens; have difficulty mobilising and require prolonged hospitalisation. After discharge from the hospital, these patients may require additional healthcare resources. Studies also show that the intensity of acute post-operative pain increases the risk of developing a persistent pain state [3]. To prevent these problems, it is important to identify these at-risk patients before surgery to optimise their post-operative pain management. A simple and convenient tool to identify these patients before surgery is therefore needed.

The primary care sector in the Region of Southern Denmark has implemented the Subgroups for Targeted Treatment (STarT) Back Screening Tool in general practice in order to identify patients who are at risk of developing complex chronic back pain [4, 5]. The STarT Back Screening Tool is a validated questionnaire, made to identify patients who are at risk of developing complex chronic back pain. It consists of nine screening items covering eight predictors: radiating leg pain, pain elsewhere, disability, fear, anxiety, pessimistic patient expectations, low mood, and how much the patient is bothered by pain. The tool score stratifies the patients into three groups that have a low, medium or high risk of developing complex chronic pain [6]. The STarT Back Screening Tool has proven to be useful in the treatment of low-back pain patients who are not candidates for spine surgery [4-14]. The tool has not previously been tested on surgical patients.

The aim of this study was to investigate if the STarT Back Screening Tool may be used to identify patients who are at a high risk of developing complex pain after spine surgery and if it can predict prolonged hospitalisation for these patients.

METHODS

A consecutive series of patients who had lumbar spine surgery between 29 October 2012 and 1 February 2013

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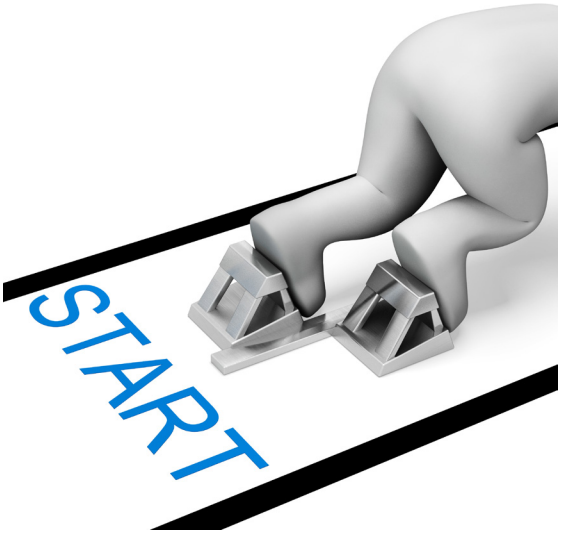

were included. Patients with dementia or patients who were unable to complete the STarT Back Screening Tool due to language limitations or physical constraints were excluded. Patients who had a prior lumbar surgery were also excluded. Two weeks prior to their surgery, the patients completed the STarT Back Screening Tool and a visual analogue scale (VAS) for leg and back pain [15], enquiring about average pain intensity in the past week. These tools were administered during the patient's pre-operative clinic visit with their physical therapist. Post-operatively, patients received standard of care management for their pain [2]. The patients were asked by the physical therapist about their current leg and back pain on a VAS at the first post-operative day and at discharge. Surgical indications and length of stay were collected as part of the Danish National Spine Registry, DaneSpine [16]. Furthermore, information on back and leg pain at 4-12 weeks after surgery and one year after surgery was also routinely collected via mail as part of DaneSpine. Patients were stratified into those who underwent decompression only for lumbar disc herniation or stenosis, and those who underwent decompression and fusion for spondylolisthesis.

All statistical analyses were conducted using IBM SPSS software version 21.0 (Somers, NY). To account for multiple concurrent analyses, the significance level was set to $p < 0.05$ level for all comparisons. One-way ANOVA was used to determine any significant differences between continuous demographic variables, and to compare pre-operative and post-operative and follow-up back and leg pain scores among the three STarT risk groups. Fisher's exact test was used to compare categorical variables between the three STarT risk groups as well as the proportion of patients achieving the VAS pain score of 30 or higher between the STarT risk groups. The rationale for using this cut-off is two-fold. First, this cut-off point is the lowest quartile for the VAS used for this study. Second, on a 0-100-point rating scale for pain, scores between 10 and 30 indicate mild pain that interferes little with activities of daily living, scores between 40 and 60 indicate moderate pain that interferes markedly with activities of daily living, and scores between 70 and 100 indicate severe pain that prevents activities of daily living [15].

Trial registration: not relevant.

RESULTS

Decompression only. Of the 174 eligible consecutive subjects, 166 (95%) completed the STarT Back Screening Tool preoperatively, with a mean age of 59.28 ± 20.07 years. There were 83 (50%) males and 83 (50%) females, and 46 (28%) were smokers. A total of 87 (52%) had decompression and discectomy for disc herniation, and 79 (48%) had a decompression for spinal stenosis.

Based on the STarT Back Screening Tool, 87 (52%) were high-risk patients, 58 (35%) were medium-risk patients, and 21 (13%) were at a low risk of developing chronic back pain. There were no statistically significant differences in demographics or surgical indication among the three risk groups. However, high-risk patients had higher pre-operative back pain and leg pain scores than the medium-risk patients, who in turn had higher scores than low-risk patients; and the differences were statistically significant (**Table 1**).

On the first post-operative day and on the day of discharge, high-risk patients had greater improvements in leg pain than the low-risk and medium-risk groups did, although the raw scores were similar for the three groups. Length of hospital stay was similar in the three risk groups, with medium-risk patients having the longest length of stay (**Table 2**).

After discharge, 158 of the 166 patients (95%) had early post-operative follow-up data: 84 (97% follow-up) from the high-risk group, 54 (93% follow-up) from the medium-risk group and 20 (95% follow-up) from the low-risk group. Patients in the high-risk group had similar improvements in back and leg pain scores as the medium-risk and low-risk groups at the 4-12-week follow-up and at the one-year follow-up (Table 2). However, there was a statistically significantly greater proportion of patients in the high-risk group with VAS back and leg pain scores of 30 or higher than in the low-risk and medium-risk groups.

Decompression and fusion for spondylolisthesis. Of the 87 eligible subjects, 78 (89%) completed the STarT Back Screening Tool preoperatively, with a mean age of 66.04 ± 18.94 years. There were 31 (40%) males and 47 (60%) females, and four (5%) were smokers. Based on the STarT Back Screening Tool, 45 (58%) of the patients were at high risk, 21 (27%) were at

medium risk, and 12 (15%) at low risk of developing chronic back pain. High-risk patients had higher back and leg pain scores than the medium-risk patients who in turn had higher scores than the low-risk patients; and the differences were statistically significant (**Table 3**).

On the first post-operative day and on the day of discharge, there was no statistically significant difference in either back-pain or leg-pain scores or improvement in scores among the different risk groups. Length of hospital stay was similar among the three risk groups, with the low-risk patients having the shorter length of stay (**Table 4**).

After discharge, only 54 (69%) of the patients had early post-operative follow-up data: 35 (78% follow-up) from the high-risk group, 11 (52% follow-up) from the medium-risk and eight (67% follow-up) from the low-risk group. There was no statistically significant difference in either back pain or leg pain scores among the different risk groups in the early follow-up period. At the one-year follow up, with 100% follow-up among the three STarT risk groups, there were no statistically significant differences for either leg pain or back pain scores between the risk groups (Table 4); and no difference in the proportion of patients with a VAS back or leg of 30 or greater.

DISCUSSION

The STarT Back Screening Tool was developed for use in the primary care setting [4-6] and is designed to identify patients with acute non-specific low-back pain who are at a high risk of developing chronic symptoms. The STarT tool uses potentially modifiable physical and psychological factors to stratify patients into low-risk, medium-risk and high-risk groups, and provides specific treatment pathways for each of these groups.

A previous randomised clinical trial matching treatment pathways to each STarT risk group showed improved patient outcomes and cost-effectiveness [10]. The STarT Back Tool has also been found to be useful in patients with chronic low-back pain, identifying patients presenting with higher levels of disability, pain and fear of movement over a 12-month period [14]. The present study is the first study investigating the use of the STarT Back Tool in a consecutive cohort of patients with low-back or leg pain presenting at a tertiary spine care centre for primary surgery.

In the original StarT Back Screening Tool article from the United Kingdom, only 12% of the patients in the primary care sample and 20% of the patients in the physical therapy sample were in the high-risk category [10]. In contrast, in the present study sample from a tertiary spine surgery facility, 52% of the patients in the decompression cohort and 58% of the patients in the fusion cohort were in the high-risk category. This may reflect the severity or chronicity of the patient's symptomatology.

Patients who underwent decompression alone for disc herniation or stenosis were analysed separately from patients who underwent a concomitant fusion.

TABLE 1

Summary of pre-operative data for each of the decompression alone Subgroups for Targeted Treatment (STarT) risk groups.

	Pre-operative STarT category			
	low risk (N = 21)	medium risk (N = 58)	high risk (N = 87)	p-value
Part of cohort, %	13	35	52	-
Age, yrs, mean ± SD	53.1 ± 21.2	62.7 ± 20.9	58.5 ± 19.9	0.153
Sex, n				0.302
Male	13	25	45	
Female	8	33	42	
Smokers, n	2	10	34	0.002
Indication for surgery, n				0.677
Decompression for disc herniation	10	33	44	
Decompression for stenosis	11	25	43	
Pre-operative pain, VAS, mean ± SD				
Back	34.7 ± 25.8	46.7 ± 25.6	58.2 ± 29.0	0.001
Leg	45.4 ± 23.7	62.0 ± 24.6	76.2 ± 17.6	0.000

SD = standard deviation; VAS = visual analogue scale score 0-100.

TABLE 2

Summary of admission data for each of the decompression alone Subgroups for Targeted Treatment (STarT) risk groups.

	Pre-operative STarT category			
	low risk (N = 21)	medium risk (N = 58)	high risk (N = 87)	p-value
Post-operative day 1				
Change in back pain, VAS, mean ± SD	14.2 ± 3.1	19.8 ± 29.3	28.3 ± 34.1	0.112
Change in leg pain, VAS, mean ± SD	36.7 ± 25.1	50.1 ± 28.3	65.4 ± 24.7	0.000
Day of discharge				
Change in back pain, VAS, mean ± SD	14.9 ± 26.0	22.5 ± 34.4	29.6 ± 32.6	0.131
Change in leg pain, VAS, mean ± SD	33.6 ± 27.5	47.0 ± 34.4	61.9 ± 25.0	0.000
Length of stay, days, mean ± SD	1.3 ± 0.6	2.2 ± 2.7	1.6 ± 0.9	0.068
4-12-week follow-up				
n	20	54	84	-
Follow-up available, %	95	93	97	-
Change in back pain, VAS, mean ± SD	10.0 ± 29.5	23.2 ± 31.4	26.5 ± 31.6	0.108
Change in leg pain, VAS, mean ± SD	26.6 ± 27.6	34.6 ± 32.7	43.7 ± 31.0	0.050
1-year follow-up				
n	21	58	86	
Follow-up available, %	100	100	99	-
Change in back pain, VAS, mean ± SD	22.4 ± 24.6	29.9 ± 32.3	25.6 ± 34.7	0.605
Change in leg pain, VAS, mean ± SD	31.1 ± 30.0	44.5 ± 33.3	44.1 ± 35.4	0.255
Back pain 〉 30 VAS, n (%)	1 (5)	13 (22)	41 (48)	0.000
Leg pain 〉 30 VAS, n (%)	5 (24)	13 (22)	40 (47)	0.005

SD = standard deviation; VAS = visual analogue scale score 0-100.

Patients with disc herniation or stenosis have more predominant leg symptoms, and decompression is a less invasive procedure, requiring shorter operative times, causing less blood loss and characterised by a quicker recovery as the muscle dissection involved is more limited [17, 18]. Patients with spondylolisthesis may have prominent back symptoms, and fusion involves a greater amount of muscle dissection, causing longer operative times, a greater blood loss and longer recovery periods in comparison with decompression-alone procedures [18].

In both the decompression and fusion groups, there was a difference in the pre-operative leg and back pain among the three StarT risk groups, with poorer scores in the higher-risk categories. This difference persisted during their hospital course and in the early post-operative course but ceased to be statistically significant. In addition, the length of hospital stay was similar among the three risk groups. This may indicate that pain control is adequate during their admission.

However, one year post-operatively, the proportion of patients with clinically significant back or leg pain (a VAS pain score of 30 or greater) [15] was also larger in the high-risk group than in the medium-risk or low-risk group. This difference in mean one-year pain scores and in the proportion of patients with persistent clinically significant pain was not seen in the decompression and fusion group. There may be several plausible explanations for this finding. Leg pain may be more disabling than back pain; the simpler decompression procedure may increase the patient's expectation of a quicker, more significant recovery. Methodologically, there may not be a large enough sample size in the fusion cohort to detect a significant difference among the three StarT risk groups.

The results of this study show that the STarT Back Screening Tool may also be used as a guide to treatment in patients undergoing lumbar surgery. Patients undergoing decompression for disc herniation and stenosis in the high-risk category may benefit from the additional treatment recommended for patients who are at a high risk of developing chronic pain problems. Further studies exploring the introduction of intensive interventions in patients in the high-risk category are necessary to determine if these interventions will be effective in decreasing the patients' pain level.

TABLE 3

Summary of pre-operative data for each of the decompression and fusion Subgroups for Targeted Treatment (STarT) risk groups.

	Pre-operative STarT category			
	low risk (N = 12)	medium risk (N = 21)	high risk (N = 45)	p-value
Part of cohort, %	15	27	58	-
Age, yrs, mean ± SD	68.3 ± 12.5	64.5 ± 17.1	66.2 ± 21.3	0.864
Sex, n				0.641
Male	6	7	18	
Female	6	14	27	
Smokers, n	1	1	2	0.860
Pre-operative pain, VAS, mean ± SD				
Back	38.6 ± 29.2	53.9 ± 25.3	62.8 ± 24.3	0.014
Leg	43.2 ± 31.4	57.4 ± 25.8	68.9 ± 16.5	0.002

SD = standard deviation; VAS = visual analogue scale score 0-100.

TABLE 4

Summary of post-operative data for each of the decompression and fusion Subgroups for Targeted Treatment (STarT) risk groups.

	Pre-operative STarT category			
	low risk (N = 12)	medium risk (N = 21)	high risk (N = 45)	p-value
Post-operative day 1				
Change in back pain, VAS, mean ± SD	7.5 ± 34.2	15.2 ± 30.7	26.8 ± 32.7	0.129
Change in leg pain, VAS, mean ± SD	34.9 ± 40.4	49.8 ± 32.4	57.7 ± 25.3	0.065
Day of discharge				
Change in back pain, VAS, mean ± SD	13.0 ± 37.6	26.1 ± 29.9	33.3 ± 28.3	0.117
Change in leg pain, VAS, mean ± SD	39.3 ± 33.6	51.3 ± 28.8	51.9 ± 28.1	0.402
Length of stay, days, mean ± SD	3.7 ± 1.7	4.7 ± 2.4	5.1 ± 2.5	0.192
4-12-week follow-up				
n	8	11	35	-
Follow-up available, %	67	52	78	-
Change in back pain, VAS, mean ± SD	29.5 ± 30.2	29.1 ± 27.7	31.1 ± 26.9	0.971
Change in leg pain, VAS, mean ± SD	28.3 ± 29.1	41.2 ± 36.1	38.8 ± 28.3	0.615
1-year follow-up				
n	12	21	45	-
Follow-up available, %	100	100	100	-
Change in back pain, VAS, mean ± SD	21.9 ± 42.7	26.3 ± 35.6	32.2 ± 36.3	0.648
Change in leg pain, VAS, mean ± SD	22.3 ± 33.9	30.0 ± 43.1	40.8 ± 36.9	0.265
Back pain > 30 VAS, n (%)	2 (17)	9 (43)	19 (42)	0.528
Leg pain > 30 VAS, n (%)	2 (17)	8 (38)	19 (42)	0.455

SD = standard deviation; VAS = visual analogue scale score 0-100.

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LITERATURE

1. Berg GH, Jensen NH, Maagaard R. Chronic pain conditions. http://pro.medicin.dk/Sygdomme/Sygdom/318162 (19 Jan 2015).
2. Olsen L. Principles of pain treatment. http://ekstern.infonet.regionsyddanmark.dk/Files/Dokument258020.htm (19 Jan 2015).
3. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. Lancet 2006;367:1618-25.
4. Morsø L, Kent P, Manniche C et al. The predictive ability of the STarT Back Screening Tool in a Danish secondary care setting. Eur Spine J 2014;23:120-8.
5. Morsø L, Kent P, Albert HB et al. The predictive and external validity of the STarT Back Tool in Danish primary care. Eur Spine J 2013;22:1859-67.
6. Hill JC, Dunn KM, Lewis M et al. A primary care back pain screening tool: identifying patient subgroups for initial treatment. Arthritis Rheum 2008;59:632-41.
7. Beneciuk JM, Bishop MD, Fritz JM et al. The STarT back screening tool and individual psychological measures: evaluation of prognostic ca-

pabilities for low back pain clinical outcomes in outpatient physical therapy settings. Phys Ther 2013;93:321-33.
8. Field J, Newell D. Relationship between STarT Back Screening Tool and prognosis for low back pain patients receiving spinal manipulative therapy. Chiropr Man Therap 2012;20:17.
9. Fritz JM, Beneciuk JM, George SZ. Relationship between categorization with the STarT Back Screening Tool and prognosis for people receiving physical therapy for low back pain. Phys Ther 2011;91:722-32.
10. Hill JC, Whitehurst DG, Lewis M et al. Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial. Lancet 2011;378:1560-71.
11. Kongsted A, Johannesen E, Leboeuf-Yde C. Feasibility of the STarT back screening tool in chiropractic clinics: a cross-sectional study of patients with low back pain. Chiropr Man Therap 2011;19:10.
12. Mehling WE, Avins AL, Acree MC et al. Can a back pain screening tool help classify patients with acute pain into risk levels for chronic pain? Eur J Pain 2015;19:439-46.
13. Murphy SE, Blake C, Power CK et al. The effectiveness of a stratified group intervention using the STarTBack screening tool in patients with LBP - a non randomised controlled trial. BMC Musculoskelet Disord 2013;14:342.
14. Pagé I, Abboud J, O'Shaughnessy J et al. Chronic low back pain clinical outcomes present higher associations with the STarT Back Screening Tool than with physiologic measures: a 12-month cohort study. BMC Musculoskelet Disord 2015;16:201.
15. McCaffery M, Beebe A. Pain: clinical manual for nursing practice. Baltimore: V.V. Mosby Company, 1993.
16. DanesSpine. http://drksdanespine.dk/wm419475 (1 Jan 2015).
17. Glassman SD, Carreon L, Dimar JR. Outcome of lumbar arthrodesis in patients sixty-five years of age or older. Surgical technique. J Bone Joint Surg Am 2010;92:77-84.
18. Mirza SK, Deyo RA, Heagerty PJ et al. Development of an index to characterize the "invasiveness" of spine surgery: validation by comparison to blood loss and operative time. Spine (Phila Pa 1976) 2008;33:2651-62.