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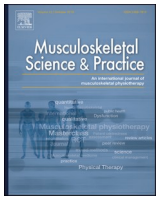

Pre-treatment risk factor assessment and safe management of the cervical spine: a survey among physical therapists

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ABSTRACT

Background: Previous research has raised the question of the extent to which physical therapists possess sufficient knowledge of cervical vascular pathologies and blood flow limitations and the clinical reasoning skills to appropriately identify a patient who is having an underlying vascular pathology.
Objectives: This study aims to investigate: (1) which risk factors are assessed during patient interviews and their frequency; (2) the physical examination tests used, therapists' training in these tests, and their confidence in performing them; (3) therapists' knowledge of cervical spine treatment risks and associated risk factors; and (4) whether these outcomes differ based on therapist characteristics.
Design: A cross-sectional digital survey.
Methods: A combination of descriptive statistics and multivariate testing.
Results/findings: 774 completed surveys were included in the data analysis. Most respondents reported routinely addressing cardiovascular risk factors, trauma history and contraindications during patient interviews. Peripheral neurological examination was most frequently used (72%), whereas auscultation (8%) and arterial pulse palpation (5%) were rarely applied. Positional testing, although no longer recommended, remained commonly used. Confidence varied, particularly for cranial nerve examination. Forty-eight percent perceived increased dissection risk after manipulation versus 15% after mobilization, and mobilization was generally considered safer.
Conclusions: Respondents sufficiently addressed risk factors in the patient interview. Regarding the physical examination, improvement of physical therapists' knowledge and skills in cranial nerve examination is needed, and positional testing should be avoided as it is no longer recommended. Participants' knowledge of cervical spine treatment risks and risk factors is variable and ongoing updating of clinical knowledge is important, as conclusions may change over time.

1. Introduction

Neck pain is a highly prevalent condition that leads to considerable pain, disability and economic cost (Wu et al., 2024). In 2020, neck pain affected 203 million individuals worldwide; however, the estimated global number of individuals affected by neck pain is projected to be 269 million in 2050, an increase of 32.5% from 2020 (Wu et al., 2024).

Many people suffering from neck pain and/or headaches receive

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treatment by healthcare providers (e.g., physical therapists, chiropractors, massage therapists, or medical physicians) (Blanpied et al., 2017; Corp et al., 2020). Rare serious adverse events (SAEs) have been reported following examination of the cervical spine, manual therapy interventions or exercise therapy (Kranenburg et al., 2017; Rushton et al., 2023). The most commonly reported SAE in the cervical spine is craniocervical artery dissection (Kranenburg et al., 2017). Although vascular SAEs have been reported to occur during or after cervical spine treatment, it remains unknown whether or not high-velocity low-amplitude thrust manipulation to the cervical spine, repeated non-thrust mobilizations to the cervical spine, or even sustained active or passive end-range cervical rotation has a causative link with SAE (Hutting et al., 2021a). The annual incidence of a spontaneous carotid arterial dissection is 2.3–3.0 per 100,000 people and the incidence of a vertebral arterial dissection is 1.0–1.5 per 100,000 people (Debette and Leys, 2009; Dziewas et al., 2003; Schievink, 2001). Vascular SAEs are more likely to occur spontaneously or in patients with vascular pathologies or patients with a predisposition to vascular pathologies who are seeking treatment (Hutting et al., 2018; Rushton et al., 2022). Therefore, the current and most plausible hypothesis is that patients presenting with neck pain and headache who go on to develop an SAE, such as a dissection, have an underlying pathology that is subsequently aggravated by treatment or assessment (Hutting et al., 2021b; Kranenburg et al., 2017). These patients present with a clinical condition that appears to be musculoskeletal, but is an underlying sinister pathology (i.e., vascular pathology/blood flow limitation) (Rushton et al., 2022).

Recent evidence indicates that several factors are associated with cervical artery dissection in the general population, including genetic factors (including migraine and connective tissue disorders), minor trauma, recent infection, and cardiovascular factors such as hypertension and hypercholesterolaemia (Jacobs et al., 2025). In clinical practice, certain relevant features may therefore be overlooked during the patient interview or physical examination. Therefore, although vasculogenic syndromes are a very rare cause of neck pain, headache, and/or orofacial symptoms, healthcare providers managing these patients should maintain an appropriate index of suspicion for vascular conditions that may mimic common musculoskeletal presentations, and understand the underlying mechanisms that may lead to vascular injury or flow limitation (Hutting et al., 2021a).

The patient history and physical examination are important in establishing and testing hypotheses related to potential vasculogenic causes of signs and symptoms and can help clinicians decide whether a medical referral for further investigation is warranted (Hutting et al., 2021a, 2021b). Therefore, extensive knowledge and skills regarding underlying mechanisms, signs and symptoms, risk factors, clinical tests and information and advice are important (Gallotti et al., 2023; Hutting et al., 2013a,b, 2018, 2020, 2021a, 2021b, 2022, 2023; Kranenburg et al., 2019; Taylor et al., 2021, 2023). The International Federation of Manual and Musculoskeletal Physical Therapists (IFOMPT) International Framework for Examination of the Cervical Region for Potential of Vascular Pathologies of the Neck Prior to Musculoskeletal Intervention (Rushton et al., 2022) was developed to assist clinicians in their clinical reasoning process. De Best et al. (2023) concluded that the IFOMPT Cervical Framework has poor diagnostic accuracy when compared with a reference standard consisting of a consensus medical decision. However, others have argued that these conclusions warrant careful consideration, as the study design and interpretation may not align with the original purpose and methodological intent of the IFOMPT Cervical Framework (Kranenburg et al., 2024). In addition, De Best et al. (2023) reported a 10% prevalence of participants classified as "high risk" in their validation study, which raises accuracy concerns for risk factor calculations (Kranenburg et al., 2024). Despite criticism of the IFOMPT Cervical Framework exists, we believe it currently represents the most comprehensive and clinically applicable approach to support clinicians in systematically considering potential underlying vascular mechanisms, including both flow limitations and structural pathology, within the assessment of patients with neck-related symptoms.

Although the dissemination and implementation of the IFOMPT Framework in educational programs appears to have been successful, questions have been raised regarding the continued teaching of functional positional testing (also known as cervical pre-manipulative positional tests) for vascular flow limitations, which are no longer recommended for clinical use (Hutting et al., 2013a,b, 2020, 2022; Kearns et al., 2024; Mourad et al., 2025). This raises the question of the extent to which physical therapists possess sufficient knowledge of cervical vascular pathologies and blood flow limitations and the clinical reasoning skills to appropriately identify the patient who is having an underlying vascular pathology, and whether this differs between physical therapists with and without additional post-graduate manual therapy education. Therefore, the aim of this study is to investigate: 1) which risk factors (and how often) they assess in the patient interview; 2) which tests they use in the physical examination, whether they have received education in the use of these tests, and how confident they feel in performing these tests; 3) the level of knowledge regarding the risks of treating the cervical spine and the associated risk factors; and 4) whether there are any differences in outcomes regarding aims 1, 2 and 3 based on several therapist characteristics, including education (physical therapists versus physical therapists with a post-graduate manual therapy education).

2. Methods

2.1. Study design

This was a cross-sectional digital survey reported according to the Checklist for Reporting Results of Internet Surveys (CHERRIES) (Eysenbach, 2004) and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (von Elm et al., 2007).

2.2. Survey development

An online survey (Qualtrics survey software) was drafted by the first author and reviewed and pretested by the other authors. All questions and statements were originally developed by the authors, with the exception of the statements regarding the perceived safety of different treatment approaches, which were adapted from previous studies (Kranenburg et al., 2020; Mourad et al., 2022; Puentedura et al., 2017). The questionnaire was piloted by five physical therapists, who provided feedback on clarity and feasibility.

In the first part of the survey, participants were asked to report demographic and professional characteristics, including age, gender, country of practice, professional experience, specialization and training background, clinical workload, and characteristics of patients treated. The survey consisted of three sections: (1) demographic and professional characteristics, (2) physical examination and patient interview practices, and (3) eight statements regarding safe management of patients with neck pain, headache or orofacial symptoms rated on a five-point Likert scale. The full survey is provided in the Appendix.

2.3. Setting and recruitment

Physical therapists worldwide who treat patients with neck pain or headache were eligible for participation. The survey was open for participation between March 12, 2021, and October 1, 2021. All member organizations of World Physiotherapy and IFOMPT were asked by email to include an announcement of the survey in their newsletter. No follow-up was done regarding the announcement. The announcement was also distributed through the authors' networks and social media (Twitter, LinkedIn, Facebook).

A link to the survey was included in the announcement. Participation

was anonymous and voluntary. Participants received study information on the first page of the survey and provided informed consent before participation. Only physical therapists treating patients with neck pain or headache were eligible to complete the survey. IP addresses were not collected.

An *a priori* sample size was calculated using a 95% confidence level, a 5% margin of error, a population proportion of 50% and a population size of 625,000 physical therapists - members of World Physiotherapy (https://world.physio/) at the time of the study - revealing a required sample size of 384 respondents.

2.4. Data processing and analysis

Descriptive statistics were used to analyze group variables, providing an overview of the means, standard deviations and ranges and medians and interquartile ranges, as appropriate, for each variable. Multivariate testing (Wilks' Lambda, Pillai's Trace) was used to investigate for significant differences between statements.

2.5. Ethics

This study was approved by the Research Ethics Committee of HAN University of Applied Sciences in the Netherlands (approval number ECO 261.04/21), and conducted in accordance with the Declaration of Helsinki, applicable national legislation, and the Dutch Code of Conduct for Research Integrity.

3. Results

3.1. Responses and participant characteristics

Twelve hundred and fifty-four (1254) physical therapists started the survey and 792 of them completed the survey and provided informed consent to participate. Eighteen (18) participants indicated that they did not treat patients with neck pain or headache and were therefore excluded, leading to 774 completed surveys that were included in the data analysis. The mean age of the participants was 44.65 years (SD 11.73; range 22-80 years). Fifty percent (50.0%) of the participants were male (n = 387), 49.6% were female (n = 384) and 0.4% preferred not to answer this question (n = 3). The respondents came from 42 different countries with the largest numbers coming from the United States (64.2%, n = 497), Norway (5.8%, n = 45) and the United Kingdom (5.7%, n = 44). An overview of participant characteristics (excluding the country of origin) is provided in Table 1.

Table 1
Demographic and clinical characteristics of the participants.

Age (mean, SD) in years	44.65 (11.73)
Gender (n, %)	
Male	387 (50.0)
Female	384 (49.6)
Prefer not to answer	3 (0.4)
Years working as physical therapist (mean, SD)	17.57 (11.84)
Specialization in manual therapy/musculoskeletal physiotherapy/orthopedic manipulative physical therapy (n, %)	
Yes	489 (63.2)
No	285 (36.8)
Manual therapy/musculoskeletal physiotherapy/orthopedic manipulative physical therapy education program approved by IFOMPT (n, %)	
Yes	295 (60.3)
No	87 (17.8)
Don't know	107 (21.9)
Highest level of education (n, %)	
Associate Degree (assistant physiotherapist)	4 (0.5)
Bachelor	162 (20.9)
Master/Master of Science	280 (36.2)
PhD/DSc	328 (42.4)
Participation in additional training, courses, webinars, masterclasses on pre-treatment assessment of the cervical spine in the last two years (n, %)	
Yes	369 (47.7)
No	405 (52.3)
Average number of patients with neck pain or headache treated per week (median, IQR)	5 (3-10)
Self-reported percentage of patients with neck pain or headache presenting via direct access physiotherapy (median, IQR)	10% (1-45%)

SD = standard deviation; IQR = interquartile range.

3.2. Questions asked in patient interview

Fig. 1 presents the percentage (%) of people presenting with neck pain, headache or orofacial pain who the respondents asked about several items such as contraindications and risk factors. In a large majority of the people presenting with neck pain, headache or orofacial pain, the physical therapist asked about the items provided.

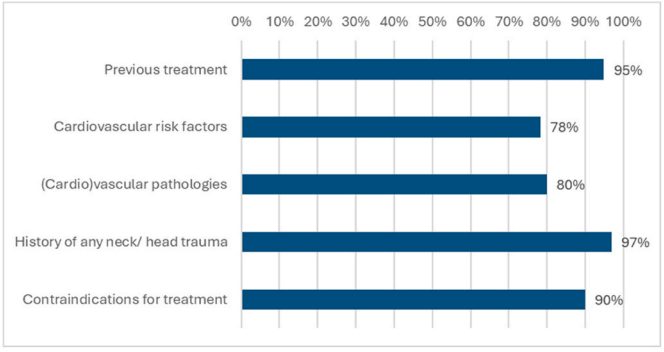

Fig. 1. Mean reported percentage (%) of patients presenting with neck pain, headache or orofacial pain in whom respondents reported specifically asking about selected items during the patient interview, including contraindications and risk factors. Respondents were asked: "Please specify in what percentage (%) of people presenting with neck pain, headache or orofacial pain you ask them in the patient interview specifically about the following items.

3.3. Use of physical tests

Fig. 2 presents the percentage (%) of people presenting with neck pain, headache or orofacial pain for whom the respondents used various physical tests. The least frequently used test is auscultation of the artery (8%), while the most frequently used test is the peripheral neurological examination (72%). Fig. 2 presents the mean reported percentage (%) of patients presenting with neck pain, headache or orofacial pain in whom respondents reported using the various physical tests.

About 18% (n = 142) of the respondents never used upper cervical ligament testing, while about 21% (n = 161) always used the tests. About 30% (n = 230) of the respondents reported never using the positional tests for the identification of blood flow limitations, while about 10% (n = 78) reported always using the tests. About 5% (n = 40) of the respondents never use peripheral neurological examination, while about 37% (n = 288) reported always using the examination. About 30% (n = 233) of the respondents never use cranial nerve examination, while about 11% (n = 87) always use cranial nerve examination. About 30% (n = 230) of the respondents never use blood pressure measurement, while about 16% (n = 123) always use this. About 67% (n = 517) of the respondents never use auscultation of the artery, while about 2% (n = 18) always use auscultation. About 60% (n = 465) of the respondents never use arterial pulse palpation, while about 5% (n = 36) always use pulse palpation.

3.4. Physical tests taught in the undergraduate physical therapy program

Fig. 3 presents the percentage (%) of the respondents who were

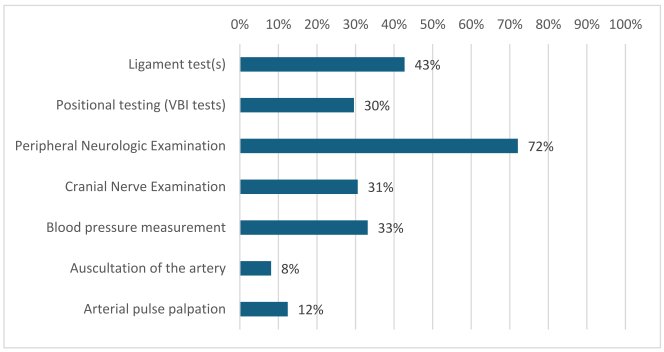

Fig. 2. Mean reported percentage (%) of patients presenting with neck pain, headache or orofacial pain in whom respondents reported using specific physical examination tests. Respondents were asked: "Please specify in what percentage (%) of people presenting with neck pain, headache or orofacial pain you use the following tests."

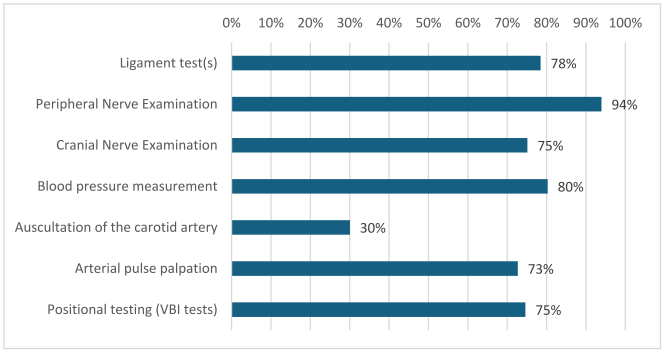

Fig. 3. Percentage (%) of the respondents who were taught various physical tests in their undergraduate physical therapy program.

taught various physical tests in the undergraduate physical therapy program, with auscultation of the carotid artery as the least frequently taught test and the peripheral nerve examination as the most frequently taught test.

3.5. Confidence in performing physical tests

The respondents' confidence in performing various physical tests is presented in Fig. 4. Respondents were most confident in performing the peripheral nerve examination and least confident in performing auscultation of the carotid artery.

3.6. Agreement with statements

Fig. 5 presents an overview of the percentages of respondents who agreed or disagreed with the statements provided. The means (range 1-5) for the different statements were as follows: statement 1 = 3.10 (SD = 1.2); statement 2 = 2.19 (SD = 1.04); statement 3 = 3.51 (SD = 0.98); statement 4 = 3.41 (SD = 1.00); statement 5 = 4.08 (SD = 1.10); statement 6 = 4.48 (SD = 0.81); statement 7 = 3.76 (SD = 1.17); statement 8 = 4.32 (SD = 0.03). Statement 6 (Mobilization in the mid- and lower cervical spine (C3–C7) is a safe treatment for patients in whom it is indicated) scored significantly higher compared to statement 5 (Manipulation in the mid- and lower cervical spine (C3–C7) is a safe treatment for patients in whom it is indicated) with a mean difference = 0.56 (p = .001). Statement 8 (Mobilization in the upper cervical spine (C0–C3) is a safe treatment for patients in whom it is indicated) scored significantly higher compared to statement 7 (Manipulation in the upper cervical spine (C0–C3) is a safe treatment for patients in whom it is indicated) with a mean difference = 0.39 (p = .001). With regard to the increased risk of arterial dissection, statement 1 (There is an increased risk of arterial dissection after cervical spine manipulation) scored significantly higher compared to statement 2 (There is an increased risk of arterial dissection after cervical spine mobilization) with a mean difference of 0.90 (p = .001) and a strong effect size (Cohen's d = 1.19).

4. Discussion

The objective of this study was to evaluate the risk factors assessed by physical therapists during patient interviews, the tests they use in the physical examination and their knowledge of the risks of cervical spine treatment and risk factors. This study highlighted that participants' knowledge of cervical spine treatment risks and risk factors is variable and, for some clinicians, may require further improvement.

4.1. Assessment of risk factors

Most respondents reported addressing key items such as previous treatment, cardiovascular risk factors, trauma history and contraindications during the patient interview. These elements are considered relevant for clinical reasoning when evaluating a potential vasculogenic contribution to symptoms (Hutting et al., 2021a). Addressing these items is important in any patient presenting with neck pain, headache or orofacial symptoms, although the likelihood of a vasculogenic cause remains low (Hutting et al., 2021a). These findings suggest that risk-related questioning is generally embedded in clinical practice.

4.2. Physical tests

Generally, participants had greater confidence in using the tests they

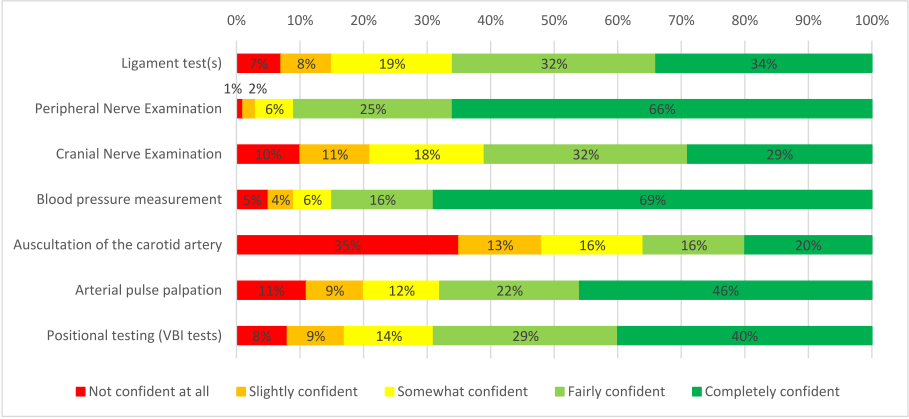

Fig. 4. Overview of respondents' confidence in performing various physical tests.

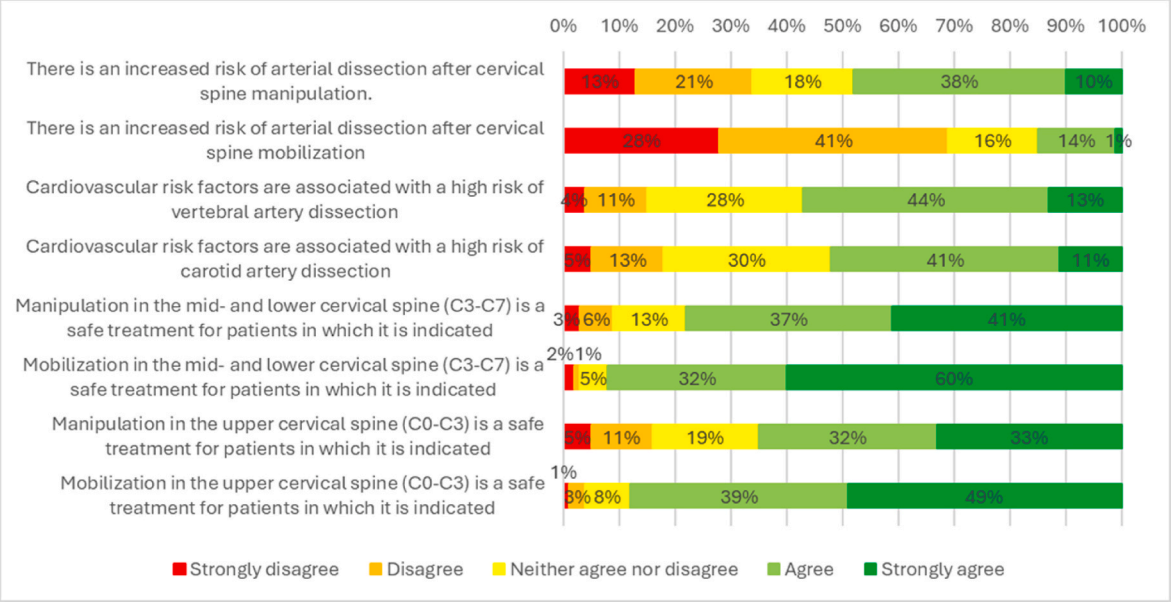

Fig. 5. Overview of the percentages (%) in which the respondents agreed or disagreed with the statements provided.

had been taught compared to tests they had not been taught. They felt most confident in performing the peripheral nerve examination and least confident in auscultation of the carotid artery. It is also important to highlight that only 61% of the participants felt fairly or completely confident in using cranial nerve examination. With regard to the frequently used upper cervical spine ligament tests, we should acknowledge that these tests may have some diagnostic utility as some alar ligaments tests, the atlanto-axial membrane test and the tectorial membrane test (Von Piekartz et al., 2019; Hutting et al., 2013a,b) showed sufficient diagnostic accuracy, while the validity of other tests, including the Sharp-Purser Test, is lacking (Hutting et al., 2013a,b; Mansfield et al., 2020).

Concerning the use of physical tests, peripheral neurological examination was used in 72% of patients presenting with neck pain, headache or orofacial pain, while auscultation of the carotid artery was only used in 8% of patients. These results are as expected, as patient history and clinical features guide the physical examination, so therapists choose these tests based on their clinical reasoning. However, the figures for the respondents who never or always use the physical tests show that 30% of respondents never use blood pressure measurement or cranial nerve examination, for example. This raises the question of whether respondents who never use these tests have sufficient knowledge and skills to perform them, as it is very unlikely that the use of these tests is never indicated, as they are regarded as an important component of musculoskeletal practice (Hutting et al., 2021b; Mourad et al., 2023; Taylor et al., 2021). Previous research has shown that a substantial proportion of Italian physiotherapists are not trained in the fundamentals of cranial nerve examination blood pressure measurement (Mourad et al., 2021). Improving physical therapists' knowledge and skills regarding in this area could have a significant impact.

With regard to the use of the cervical positional tests, 10% of respondents always use these tests. In addition, 30% never use pre-manipulative positional testing, meaning that 70% of respondents do use these tests in clinical practice. Given that positional tests were used in 30% of patients, it suggests that participants quite often used these tests in clinical practice. As mentioned before, these tests were also included in most educational programs, which has also been found in previous research (Hutting et al., 2022; Kearns et al., 2024). However, the validity of the cervical positional tests and the rationale of these tests are lacking (Hutting et al., 2013a,b, 2018, 2020, 2021a; Kranenburg et al., 2019; Rushton et al., 2022). Moreover, A negative VBI test can easily be wrongly interpreted as 'safe to treat' and the tests might even harm the patient as the test potentially could further occlude the artery (Hutting et al., 2013a,b, 2020). Therefore, the use of cervical pre-treatment positional testing is no longer recommended (Hutting et al., 2013a,b, 2020, 2021b) and these tests have been excluded from the IFOMPT Framework (Rushton et al., 2023). We can conclude that the use of positional testing is still common practice in musculoskeletal physical therapy. Auscultation of the carotid artery is not widely used in clinical practice, clinicians often do not feel confident in its use, and these tests are only taught in a limited number of educational programs. Although included in the IFOMPT Framework, the clinical applicability of these tests is uncertain, and arterial pulse palpation may be a more feasible alternative.

4.3. *Knowledge about risks and risk factors*

The knowledge of the participants regarding the risks of treatment of the cervical spine and risk factors is insufficient. Forty-eight percent of participants agreed or strongly agreed that there is an increased risk of arterial dissection after cervical spine manipulation, compared to 15% for the risk after mobilization. Concerning the increased risk of arterial dissection, manipulation scored significantly higher compared to mobilization. The most common serious adverse event in the cervical spine is craniocervical artery dissection (Kranenburg et al., 2017). However, contemporary evidence suggests that serious adverse events are more likely related to underlying pathology than to a specific treatment technique (Cassidy et al., 2008, 2017; Hutting et al., 2021a; Rushton et al., 2023).

Regarding the association between cardiovascular risk factors and vertebral and carotid artery dissection, the majority of participants (57% and 52%, respectively) agreed or strongly agreed with the statements. At the time of this survey, the evidence suggested that cardiovascular risk factors are not risk factors for dissection vascular events, as opposed to a recent trauma or vascular anomalies (Rushton et al., 2023). That means most respondents were insufficiently aware of the evidence at that time. However, a new systematic review concluded that cardiovascular factors (hypertension, hypercholesterolaemia, relative vasodilatation of internal carotid, coronary artery disease and other cardiac diseases) are indeed risk factors for cervical artery dissection (Jacobs et al., 2025). In light of the new evidence, these responses can now be considered substantively correct; however, these findings also illustrate the challenges

clinicians face in keeping pace with an evolving evidence base. Rather than indicating incorrect knowledge alone, the results highlight the need for continued updating of education and clinical resources as evidence develops. However, caution is needed in interpretation as the evidence is overall low to very low certainty, except for migraine and MTHFR TT homozygosity (a homocysteine-regulating gene that has been associated with elevated homocysteine levels in several studies, which has been discussed in relation to vascular and connective tissue vulnerability) (Jacobs et al., 2025). Moreover, recent symptomatic prediction work by Thomas et al. (2024) suggests that combinations of clinical features — acute onset, unusual headache or neck pain, recent trauma or infection, and more than two neurological signs — may have diagnostic value in identifying cervical artery dissection in emergency department cohorts. However, this tool is currently at a derivation stage and requires further validation in independent clinical samples before widespread clinical application can be recommended.

Significant differences were found in participants' perceptions of risk between mobilization and manipulation, with mobilization generally considered safer. Similar differences were observed between treatment of the upper versus the mid- and lower cervical spine. These findings likely reflect longstanding beliefs within clinical practice rather than differences supported by current evidence. A recent systematic review by Leung et al. (2025) reported that spinal manipulations were involved in the majority of published adverse event cases, including vascular events, whereas mobilizations were reported far less frequently. These findings are largely derived from case reports and case series and may be influenced by publication and reporting bias. However, the findings of a recent systematic review suggested that cervical spinal manipulative therapy is not a significant risk factor for cervical arterial dissections (Jacobs et al., 2025). Available evidence suggests that cervical arterial dissections are more likely related to pre-existing vascular pathology than to a specific treatment technique (such as manipulation), indicating that the treatment modality itself may be of limited importance in relation to vascular risk (Rushton et al., 2023). From this perspective, the event is primarily related to a pre-existing vascular vulnerability rather than to the specific treatment label itself. In theory, it cannot be excluded that a high-velocity thrust technique might exert different mechanical forces compared to a mobilization and could potentially influence an already existing dissection differently; however, there is currently no high-quality evidence demonstrating a differential causal effect between techniques. Therefore, while technique selection may warrant consideration, emphasis should remain on thorough risk assessment, appropriate patient selection, and accurate training and competent execution of manual therapy techniques as essential components of safe practice. Likewise, there is no evidence supporting a difference in vascular risk between cervical spine levels (Arnold et al., 2006), and from a vascular risk assessment perspective, the clinical reasoning process and associated physical examination should therefore be similar regardless of the cervical region treated (Hutting et al., 2021a).

4.4. Strengths and limitations

As far as we know, this is the first global survey evaluating the risk factors assessed during the patient interview, the physical tests used in clinical examination, and physical therapists' knowledge regarding risks associated with cervical spine treatment. A strength of this study is the large international sample (n = 774), complementing previous work focusing on educational programs and IFOMPT member organizations (Hutting et al., 2022; Mourad et al., 2025). Several limitations should be considered. As a survey study, the findings reflect clinicians' self-reported perceptions and knowledge rather than actual clinical behaviour or real-time clinical reasoning. Although the sample was international, the large proportion of participants from the United States may have influenced the results. The use of closed-ended questions limited deeper exploration of participants' beliefs and reasoning, and responses may have been affected by recall bias and estimation error when reporting the frequency of test use or risk assessment. In addition, physical tests were not operationally defined, which may have led to variability in interpretation among respondents. Furthermore, for most of the physical tests queried - apart from ligament tests and positional testing for vertebrobasilar insufficiency (VBI) - diagnostic accuracy is unknown or insufficiently established, and the reported use of these tests should therefore not be interpreted as evidence of valid vascular screening procedures.

4.5. Recommendations

Based on our findings, clinicians should continue to update their knowledge, skills and beliefs regarding contemporary risk assessment and clinical reasoning for safe cervical spine management. Educational programs may also need to review and update their curricula where necessary, particularly as previous research has shown that not all programs fully align with the IFOMPT Framework (Hutting et al., 2022). Clinical practice guidelines may similarly benefit from updating recommendations related to vascular risk assessment, as previous work has highlighted limited guidance on identifying patients at risk for vascular complications (Peters et al., 2025) as well as a lack of consensus regarding the validity and use of traditional red flags (Feller et al., 2024). The findings may further inform future revisions of the IFOMPT Framework. Finally, further research, including qualitative studies, is warranted to better understand the origins of clinicians' beliefs and to support implementation of contemporary practice.

4.6. Conclusion

Respondents in this survey generally reported addressing relevant risk factors during the patient interview. However, variation remains in physical examination practices, particularly regarding cranial nerve examination and auscultation of the carotid artery, where confidence and use varied, and positional testing, which is no longer recommended but remains common in clinical practice. Participants' knowledge regarding cervical spine treatment risks and risk factors appeared variable, highlighting the need for continued updating of clinical knowledge in an evolving evidence base. These findings support ongoing efforts to update clinicians' knowledge and skills, as well as continued development of educational programs and clinical practice guidelines in line with contemporary approaches to risk assessment and clinical reasoning.

CRediT authorship contribution statement

Nathan Hutting: Writing – review & editing, Writing – original draft, Visualization, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Firas Mourad:** Writing – review & editing, Conceptualization. **Alan Taylor:** Writing – review & editing, Conceptualization. **Wilfred Wilbrink:** Writing – review & editing. **James Dunning:** Writing – review & editing. **Roger Kerry:** Writing – review & editing, Conceptualization. **Rik Kranenburg:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Ethics

The Research Ethics Committee of HAN University of Applied Sciences reviewed and approved this study (approval number ECO 261.04/21).

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Declaration of interests

Given their role as deputy editor, Nathan Hutting had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to another journal editor.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.msksp.2026.103542.

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