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Impact of Multidisciplinary Team Meetings on Decision Making in Vascular Surgery: A Prospective Observational Study

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WHAT THIS PAPER ADDS

Multidisciplinary team meetings (MDTs) are strongly recommended in several areas of vascular disease in most guidelines (class I), yet available evidence is lacking (level C). In this study, the impact that multidisciplinary discussion had on the treatment of vascular patients was prospectively evaluated. The results showed that the MDT frequently led to significant changes in the treatment decision compared with the treatment recommendation from a single specialist. Although further research will be required to determine the concordance of treatment recommendations between multidisciplinary teams and clinical decision algorithms, this study supports the guideline recommendation to include structured multidisciplinary decision making for vascular patients.

Objective: This cohort study aimed to prospectively determine the impact of multidisciplinary team meetings (MDTs) on treatment plans in vascular patients.

Methods: The weekly MDT at the institution consists of a structured discussion of vascular cases in the presence of at least one representative of each specialty from vascular surgery, angiology, and interventional radiology. Participants were asked to examine the cases entered on the digital MDT platform and to fill in forms with a detailed open text treatment recommendation for each patient. Individual recommendations were compared with the final MDT decision, which was based on a shared decision upon discussion of clinical and radiological data. The primary endpoint was the agreement rate. The rate of decision implementation was determined to verify the adherence to MDT recommendations.

Results: Four hundred consecutive case discussions in 367 patients between November 2019 and March 2021 were included, excluding patients needing urgent treatment, yielding MDT discussion in 88.5% of carotid artery cases, 83% of aorto-iliac cases, and 51.7% of peripheral arterial cases, which included 56.9% of the chronic limb threatening ischaemia cases. The overall average agreement rate was 71% ± 41%. Analysis according to the specialty of the attending physician showed agreement rates of 82% ± 30% for senior vascular surgeons, 62% ± 44% for junior vascular surgeons, 71% ± 43% for interventional radiologists, 58% ± 50% for angiologists ($p < .001$), and 75% ± 38% considering only senior practitioners. The inter-rater agreement, resulted in kappa coefficients of 0.60 – 0.68 for senior vascular surgeons, 0.29 – 0.31 for junior vascular surgeons, 0.39 – 0.52 for interventional radiologists, and 0.25 for angiologists. The MDT treatment decision was implemented in 353 (96.2%) cases.

Conclusion: The impact of MDT discussion on treatment recommendations and the adherence to MDT recommendations were significant and in line with results reported from other specialties.

Keywords: Intervention, Multidisciplinary, Vascular

<H1>INTRODUCTION

Multidisciplinary team meetings (MDTs) were originally introduced in the care of patients with cancer to address the growing complexity of decision making due to a significant increase of available treatment options.[1,2]

The clinical effectiveness of MDTs has subsequently been demonstrated in other areas of healthcare such as congestive heart failure,[3] chronic pulmonary disease,[4] and diabetic foot care.[5] Relevant guidelines and some national societies strongly recommend (class I) MDTs in vascular surgery.[6–11] Following these recommendations, the constitution and use of vascular MDTs are spreading in several countries worldwide. However, evidence on the effectiveness of MDTs in terms of clinical outcome is still limited (evidence level C). Given the time and resources that are required for a soundly constituted MDT, efforts have been made to produce more robust evidence of their effectiveness in selected areas of vascular surgery.[12–14]

Retrospectively comparing clinical outcomes with results preceding the introduction of MDTs would be biased by the evolution of devices and techniques. The retrospective quality assessment of MDTs is mostly based on the determination of the rate of adherence to MDT decisions, defined as the rate of decision implementation, which is a good indicator of MDT structural quality but does not necessarily warrant better clinical outcomes. In this study, the MDT was hypothesised to lead to significantly more weighed decisions in clinical practice compared with single physician based decisions. Given the difficulties in providing evidence for the usefulness of MDTs, this study aimed to assess the impact of a multidisciplinary discussion on the treatment plan proposed by individual physicians.

<H1>MATERIALS AND METHODS

<H2>*Study design and patient selection*

This prospective cohort study was carried out in the Vascular Unit of the Ente Ospedaliero Cantonale, Ticino, Switzerland, which consists of a Vascular Surgery Division, Service of Angiology, and Service of Interventional Radiology, serving four hospitals in southern Switzerland. The study

protocol was evaluated by the local ethics committee, who waived informed consent in accordance with Swiss legislation. The study protocol was not published or registered *a priori*.

At the institution a formally structured MDT was established in 2011, with weekly discussion of vascular cases. The regulatory protocol requires the presence of at least one vascular surgeon, one interventional radiologist, and one angiologist as core participants at each session. Additionally, the discussion of supra-aortic vessel cases, and of thoracic aortic and of vascular access cases requires the presence of at least one neurologist and one neuroradiologist, one cardiac surgeon, and one nephrologist respectively. To optimise resources, revascularised patients with diabetes are discussed in a separate diabetic foot MDT in the presence of a vascular surgeon, a foot surgeon, a diabetologist, a specialised nurse, and an orthotic technician. Physicians with vascular activity from all four hospitals are required to present all vascular cases for discussion and to actively participate at the MDT, excluding only urgent cases requiring intervention sooner than the upcoming MDT. All cases to be discussed have to be entered on a digital platform accessible to all MDT participants no later than 3 hours before the multidisciplinary team session. Besides all digitally available clinical data and imaging, the primary clinician was required to register all relevant information, including the patient's personal preferences, compliance, general condition, quality of life and living conditions, and all information deemed useful to meet a treatment decision. For this study, only core MDT participants (three senior vascular surgeons, two junior vascular surgeons, two interventional radiologists, and two angiologists) were surveyed. Additional specialists who participated in the MDT discussion of specific cases did not participate in the study because of their limited involvement. Participating physicians were required to provide a treatment recommendation in open text format in a column on the patient presentation chart. This solution was preferable to a multiple choice system, which would have generated a bias based on the determination of the available treatment options to choose from. Specification of treatment details was encouraged, such as type of conduit, treatment timing, type of endovascular device to be used, and all major specifications regarding the procedure. If the physician was unable to propose a treatment, two additional options

were available, namely justified abstention (e.g., need for further investigation or clinical information) and unjustified abstention. The open text recommendations were returned to the principal investigator before the beginning of the MDT session. The MDT final decisions, which were electronically recorded at the end of the discussion, were compared with the written single physician recommendations by two independent reviewers, who had not participated in the MDT session. The following criteria were applied to determine the agreement: (1) inherently different procedures and different timing of procedures were considered as non-agreement; (2) similar procedures with no evidence supporting one choice over the other were considered in agreement; and (3) Similar procedures with evidence supporting one choice over the other were considered non-agreement

Justified abstentions were considered in agreement only if the MDT decision also recommended further investigation or integration of missing information, whereas unjustified abstention was always categorised as non-agreement. The principal investigator subsequently compared the evaluations of the reviewing physicians and presented all discrepancies for discussion and resolution at the next MDT. All patients with vascular disease, who were discussed in the multidisciplinary vascular board from November 2019 to March 2021, were prospectively included. Patients requiring urgent treatment sooner than the upcoming MDT session were excluded. All cases that were not entered for multidisciplinary discussion were also excluded. MDT sessions without the required core participants were cancelled and the cases were rescheduled for the following session. If the additionally required specialists for carotid, thoracic aortic, and vascular access cases were not present, the related case was rescheduled for discussion at the next MDT. Junior and senior practitioners were separated in the secondary endpoint analysis with a threshold of five years of post-specialty training.[15] The aim of this subanalysis was to assess the impact that MDTs may have on the training of junior specialists. Participating physicians were informed about the study and were provided with the study protocol.

<H2>*Data collection and endpoints*

For every patient, data were anonymised with limited access. Data included the date of board discussion; vascular segment or pathology (supra-aortic, thoracic aorta, aorto-iliac segment, endoleak related, peripheral arterial, arterio-venous fistulas, visceral arteries, central venous, arterio-venous malformations); proposed treatment of senior and junior vascular surgeons, interventional radiologists, and angiologists; decision of the primary clinician, and final board decision. All patients were followed up until completion of recommended treatment. When conservative treatment was recommended, it was considered implemented if it was maintained until new clinical events occurred.

The primary endpoint was the agreement rate with the final MDT decision, which was determined by two independent reviewers. The secondary endpoints were the agreement rate in subgroup analysis according to specialty, experience, vascular district, or pathology involved and between the primary physician and other attending physicians who had no previous clinical encounter with the patient. The variability of agreement over time in junior vascular surgeons was also analysed. Junior practitioners from other specialties do not routinely participate in MDT sessions and could not be included in the study. The rate of decision implementation was determined, and the reasons for non-implementation were followed up. The inter-rater agreement[16] was defined as the degree of accordance among independent participants to the vascular board who assessed the same patients.

<H2>*Statistical analysis*

Descriptive statistics were presented as absolute frequencies for categorical variables with mean and standard deviation or median with interquartile ranges (IQRs) and 95% confidence interval (95% CI) for continuous variables. The chi-squared test was used to compare dichotomous values, whereas analysis of variance was used to compare continuous variables.

Cohen's kappa coefficient was used to measure the inter-rater agreement, also providing the 95% CI. The sample size of 187 cases was estimated assuming a Cohen's kappa of 0.44, a minimum acceptable kappa (k0) of .2, a two-tailed significance level of .05, and a power of .8.[17–19] Statistical significance was considered at $p < .05$ and the Bonferroni adjustment was used to correct the p value

threshold in case of multiple comparisons for the primary outcome. Statistical analyses were performed using MedCalc Statistical Software version 20.013 (MedCalc Software Ltd., Ostend, Belgium; https://www.medcalc.org; 2021).

<H1>RESULTS

Four hundred case discussions in 367 patients took place at the multidisciplinary vascular board between November 2019 and March 2021. Thirty-two (8.7%) cases were discussed in multiple sessions, of which 31 were discussed twice and one was discussed three times, the latter because of intercurrent clinical events and change in the patient's preference. Fourteen (3.8%) cases were re-presented by the treating physician to propose a change in treatment recommendation or a re-discussion after further findings: in two cases the original treatment recommendation was confirmed. The MDT was cancelled twice for unattendance of the required participants and all cases were re-scheduled for the following session. Fifty-four cases (13.5%) pertained to supra-aortic vessels, 16 (4.0%) to thoracic aorta, 131 (32.7%) to aorto-iliac segment pathologies, 33 (8.3%) to endoleaks after endovascular repair of aortic lesions, 98 (24.5%) to peripheral arterial disease, 21 (5.2%) to dialysis access, 29 (7.2%) to visceral arteries, 12 (3.0%) to central venous disease, and six (1.5%) to arterio-venous malformations. Of all non-urgent cases, 99.2% were discussed and included in the study, excluding amputations and peripheral venous cases. Three patients with intermittent claudication were directly referred to the interventional radiologist by an external angiologist without MDT discussion. During the study time, 141 urgent cases were treated without prior MDT discussion, yielding a multidisciplinary discussion in 88.5% of carotid artery cases, and 83% of aorto-iliac cases, 51.7% of peripheral arterial cases (56.9% of chronic limb threatening ischaemia cases, 95.1% of intermittent claudication cases, 4.7% of acute and acute on chronic ischaemia cases). The study period overlapped the first two Covid-19 waves in Switzerland. During the pandemic there was a decrease in consultations, in non-urgent referrals and in elective activity. This increased the proportion of urgent treatments (37.2% of all cases), most of which (74.6%) could not be discussed at the MDT.

Although the minimum requirement for MDT validity was the presence of one senior vascular surgeon, one interventional radiologist, and one angiologist, in 47% of discussed cases a second radiologist was present, in 98% two or more senior vascular surgeons were present, and in 93% at least one junior vascular surgeon was present and in 34% a second angiologist was present. Three hundred and sixty-eight (92%) cases had at least one clinical assessment with the primary clinician prior to MDT presentation. On average, the agreement rate with final board decision was 71% ± 41% considering all participants. Subgroup analyses according to specialty and years of experience (Fig. 1) showed agreement in 82% ± 30% for senior vascular surgeons, 62% ± 45% for junior vascular surgeons, 71% ± 43% for interventional radiologists, 58% ± 50% for angiologists ($p < .001$ between all groups except between angiologists and junior surgeons) and 75% ± 38% considering only senior practitioners regardless of specialty. No significant difference ($p = .18$) was observed when comparing the agreement rates of the primary clinician (69% ± 48%) with those of other attending physicians (75% ± 41%). According to the Bonferroni adjustment for multiple comparisons, a *p* value threshold of .005 was considered statistically significant. Therefore, a significant difference in agreement rate could be still detected between all specialties except for junior surgeons *vs.* angiologists who scored similarly.

A detailed subgroup analysis according to the vascular segment and pathology is shown in Table 1. Regarding the inter-rater agreement, the kappa coefficient was 0.59 (95% CI 0.50 – 0.68), 0.66 (95% CI 0.58 – 0.75), and 0.67 (95% CI 0.59 – 0.76) for senior vascular surgeons, 0.24 (95% CI 0.12 – 0.37) and 0.25 (95% CI 0.13 – 0.38) for junior vascular surgeons, 0.35 (95% CI 0.22 – 0.48) to 0.49 (95% CI 0.36 – 0.61) for interventional radiologists, and 0.13 (95% CI 0 – 0.34) for the angiologists. The MDT decision was implemented in 353 (96.2%) cases. Of the 12 non-implemented cases, four patients refused treatment; two patients were treated elsewhere; two patients were found to have concomitant disease deemed prohibitive at pre-operative work up; three patients had severe complications due to treatment of a concomitant disease; and one patient died from myocardial infarction before treatment. No patients were lost to treatment implementation follow up.

To assess the impact of MDTs on the training of young vascular surgeons, the variability of agreement over time for junior vascular surgeons was analysed by dividing the study period in three equal segments and comparing their performance. The agreement rate was 59.6% ± 46.1% in the first period and 65.1% ± 44.3% in the last. However, this difference did not reach statistical significance (p = .33).

<H1>DISCUSSION

Most recent guidelines strongly recommend a structured multidisciplinary approach for the treatment of vascular patients. However, strong evidence supporting the effectiveness of MDTs in terms of improved clinical outcome is difficult to obtain even in cancer care[20,21] and is lacking in the treatment of many areas of vascular disease. Moreover, the organisation and implementation of MDTs remain time and resource consuming. The present study found that individual treatment recommendations were in agreement with MDT decisions in 71% of cases considering all participants, regardless of specialty and years of post-specialisation experience. Even when including only practitioners with at least five years of post-specialty experience, the agreement rate did not exceed 75%. Senior vascular surgeons and interventional radiologists displayed the highest agreement rates (82% and 71%) due to their detailed knowledge of available treatment options. Senior vascular surgeons displayed the highest agreement rate in most areas. This may indicate an excessive influence in the discussion and decision process, which represents a potential bias. When observing the general trend in agreement rates, the performance of interventional radiologists significantly decreased in the discussion of supra-aortic vessel disease. The reason for this was the difference in experience between the two interventional radiologists who participated in the study, where one had limited experience in treatment in this area. In this study, the agreement rate of angiologists was significantly lower in most areas. This can be explained by the fact that strict parameters in evaluating the agreement of two proposed treatments were applied. Different technical aspects, such as type of approach and type of materials used, for which there is available evidence, where considered not equivalent in the evaluation by the two reviewers. At the institution angiologists do not take part in interventional

procedures, which may limit their knowledge of some technical aspects of open and endovascular procedures. Interestingly, the shared decision did not match any of the proposed treatments in five cases, indicating that multidisciplinary discussion generated an option that had not been considered during individual evaluation. Even though it is a small percentage, it highlights the synergistic effect of structured case discussions. The wide standard deviation (SD) in the results indicates that there was a relevant variability in the number of specialists who agreed with the MDT decision. The overall results are comparable with data published for a thoracic multidisciplinary tumour board,[22] where MDT recommendations differed from the initial treatment plan in 26% of patients with oesophageal cancer and 40% of patients with lung cancer.

The rate of decision implementation has often been used as a MDT structural quality indicator. This study showed an implementation rate of 96.2%. This is in the upper end of reported rates that ranged between 69% and 97%.[13,22–26] Strategies to yield a high rate of implementation in cancer MDTs have been thoroughly studied and described in some relevant reviews.[27,28]

The common impression among participating physicians in this study was that the extra time spent to carefully evaluate the cases before the MDT was greatly outweighed by an increase in quality and time efficiency of the MDT discussion itself. Junior participants also seemed to profit more from the multidisciplinary discussion by being required to provide a treatment plan prior to discussion. However, the progression of their agreement rate over the study period did not reach statistical significance.

<H2>*Study limitations*

This study has limitations. Primarily, the treatment plans proposed by the MDT attending physicians other than the primary clinician, who has had at least one clinical encounter with the patient in most cases, are mostly based on clinical data and imaging. A personal encounter together with a direct physical examination of the patient may influence the choice of a recommended treatment. To mitigate this effect, all primary clinicians were asked to provide essential information about quality of life, level of fitness, and personal preference on the electronic platform prior to MDT discussion.

These patient centred assessments carry by default some degree of personal interpretation by the primary clinician, who may have influenced the individual decision of other physicians. This strategy may have reduced the decisional difference between the primary clinician and all other attending physicians, making it non-significant (69% ± 48% and 75% ± 41%, respectively). It is also important to acknowledge that the results reported are relevant to the setting of the MDT. The development of a treatment strategy is known to be affected by the expertise and by several infrastructural parameters. There is also a lack of consensus regarding the constitution and ruling of MDTs. For these reasons it is difficult to determine the exact applicability to other centres across Europe and globally.

The activity of angiologists and their degree of involvement in interventional procedures may also vary greatly between different centres and countries. As mentioned in Materials and Methods, participating physicians were informed about the study and its aims, making results potentially influenced by observer bias. A further limitation is intrinsic to the structure of the MDT that does not involve anaesthetists in the discussion. The presence of anaesthetists at the MDT would likely reduce the need for multiple case discussions and may further reduce non-implementation rates. Another critical aspect is that the MDT generated treatment recommendation is not independent from the individual recommendation of each physician, who will have different degrees of influence on the shared decision. In order to avoid this, the study should have been conducted using individual treatment recommendations from physicians who did not participate in the MDT discussion. This was unfortunately not feasible in this setting. Groupthink,[29] where disagreement exists but is not expressed, and excessive dominance by some attending physicians are two potential biases to all MDTs but are difficult to quantify and to prevent. Additionally, there is a risk, in this study, of excessive influence by senior vascular surgeons who consistently showed the highest agreement rate in most areas. However, analyses to detect this bias is complex and goes beyond the purpose of the study. From a statistical perspective, results were collected as percentages and did not follow a normal distribution. Therefore, it was decided not to use medians with IQR because differences between specialist groups would not be displayed, considering the reduced number of specialists for each

discipline. Although reporting the results with mean ± SD is not ideal, it is largely accepted in medical statistics in these cases. Finally, a selection bias exists from the exclusion of patients needing urgent treatment before the next scheduled MDT. It is believed that this represents a real world situation since most structured MDTs will not be able to secure the discussion of all urgent cases.

<H2>*Conclusion*

The impact of the MDT was clinically significant when comparing single physician treatment recommendations with treatment plans generated after multidisciplinary discussion. This finding supports the guideline recommendations to routinely adopt a structured multidisciplinary discussion in several areas of vascular disease. The adherence to MDT treatment recommendations was in the upper end when compared with available data from literature.

CONFLICT OF INTEREST

None.

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Table 1. Rates of agreement with final vascular board decision.

Vascular district	Number of cases	Senior vascular surgeons	Junior vascular surgeons	Interventional radiologists	Angiologists	*p*
Overall	400	82 ± 30*†‡	62 ± 45*	71 ± 43†	58 ± 50‡	<.001
Supra-aortic vessels	54	85 ± 27*	64 ± 45	44 ± 49*	64 ± 50	.004
Thoracic aorta	16	78 ± 30	37 ± 50	50 ± 52	50 ± 58	.098

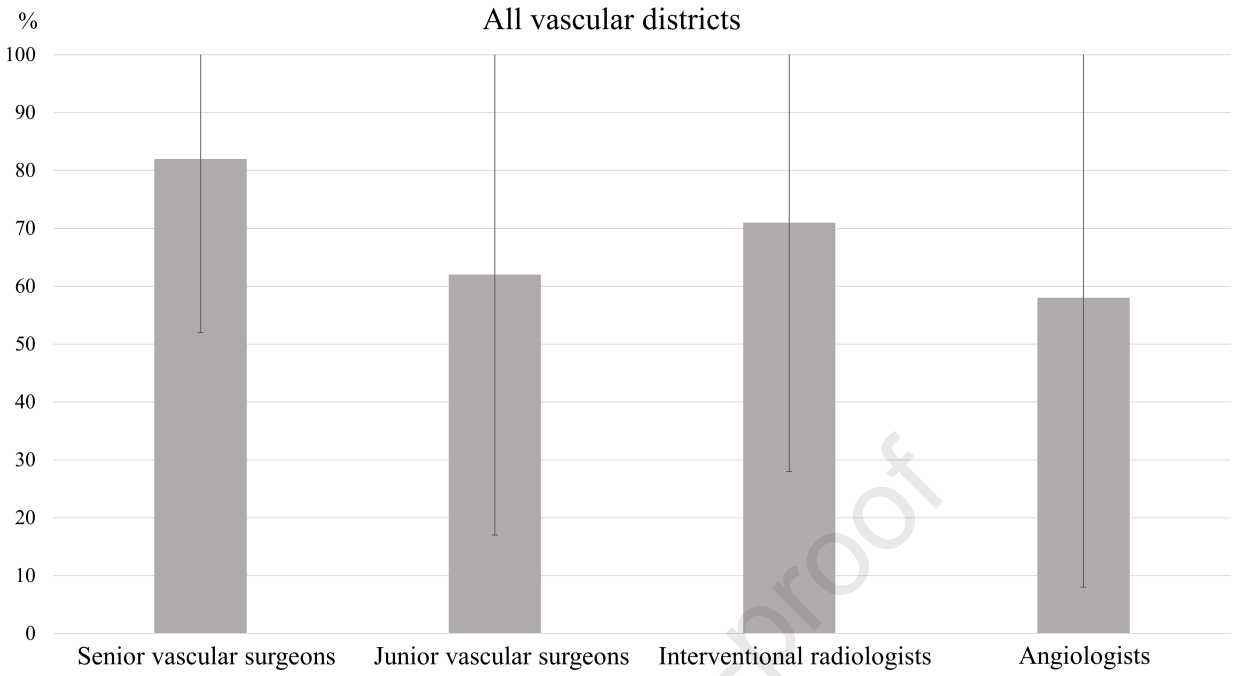
Aorto-iliac segment	131	81 ± 31[*†]	62 ± 43[*]	77 ± 39[‡]	52 ± 51[†‡]	<.001
Endoleaks	33	70 ± 35	52 ± 50	78 ± 39	62 ± 52	.15
Peripheral arteries	98	87 ± 24	70 ± 43	78 ± 39	62 ± 51	.008
Dialysis access	21	81 ± 29	67 ± 49	50 ± 41	50 ± 58	.12
Visceral arteries	29	79 ± 37	60 ± 42	75 ± 43	50 ± 55	.21
Central veins	12	83 ± 33	54 ± 45	71 ± 39	100 ± 0	.22
Malformations	6	92 ± 38	20 ± 45	83 ± 41	100 ± 0	.046

391 Continuous variables are expressed as mean percentage ± standard deviation for agreement with
392 board decisions.

393 *†‡Indicate a statistically significant difference between groups ($p < .005$).

394 **Figure 1.** Histogram depicting the agreement rate of the different specialists with the final

395 multidisciplinary team decision considering all vascular districts discussed.



Short title: Impact of Multidisciplinary Team Meetings

Figure 1: follow pages E1 and E2

Supplementary material

Supplementary file, MDM digital platform with translation

Supplementary file, MDM protocol

Supplementary file, Patient MDM form, with translation

Supplementary file, Regolamento_MDM Vascolare

Supplementary file, Regulation MDM translated