

**U.** PORTO

**FMUP** FACULDADE DE MEDICINA  
UNIVERSIDADE DO PORTO

**MESTRADO INTEGRADO EM MEDICINA**

---

2019/2020

Daniela Alexandra Lopes Barros Ferreira Pinheiro  
Impact of Sarcopenia in Aorto-Iliac Occlusive Disease

JANEIRO, 2020

FMUP

**U.** PORTO

**FMUP** FACULDADE DE MEDICINA  
UNIVERSIDADE DO PORTO

Daniela Alexandra Lopes Barros Ferreira Pinheiro  
**Impact of Sarcopenia in Aorto-Iliac Occlusive Disease**

**Mestrado Integrado em Medicina**

**Área: Cirurgia Vasculiar**

**Tipologia: Dissertação**

**Trabalho efetuado sob a Orientação de:**

**Dr. João Rocha Neves**

**E sob a Coorientação de:**

**Dr. Marina Felicidade Dias Neto**

**Trabalho organizado de acordo com as normas da revista:**

**Journal of Surgical Research Open Access Articles**

**JANEIRO, 2020**

**FMUP**

Eu, Daniela Alexandra Lopes Barros Ferreira Pinheiro, abaixo assinado, n.º mecanográfico 201400564, estudante do 6.º ano do Ciclo de Estudos Integrado em Medicina, na Faculdade de Medicina da Universidade do Porto, declaro ter atuado com absoluta integridade na elaboração deste projeto de opção.

Neste sentido, confirmo que **NÃO** incorri em plágio (ato pelo qual um indivíduo, mesmo por omissão, assume a autoria de um determinado trabalho intelectual, ou partes dele). Mais declaro que todas as frases que retirei de trabalhos anteriores pertencentes a outros autores, foram referenciadas, ou redigidas com novas palavras, tendo colocado, neste caso, a citação da fonte bibliográfica.

Faculdade de Medicina da Universidade do Porto, 01/01/2020

Assinatura conforme cartão de identificação:

Daniela Alexandra Lopes Barros Ferreira Pinheiro

NOME

Daniela Alexandra Lopes Barros Ferreira Pinheiro

NÚMERO DE ESTUDANTE

E-MAIL

201400564

danyoffice@gmail.com

DESIGNAÇÃO DA ÁREA DO PROJECTO

Angiologia e Cirurgia Vascular

TÍTULO DISSERTAÇÃO

Impact of Sarcopenia in Aorto-Iliac Occlusive Disease

ORIENTADOR

João Manuel Palmeira Rocha Neves

COORIENTADOR (se aplicável)

Marina Felicidade Dias Neto

ASSINALE APENAS UMA DAS OPÇÕES:

É AUTORIZADA A REPRODUÇÃO INTEGRAL DESTA TRABALHO APENAS PARA EFEITOS DE INVESTIGAÇÃO, MEDIANTE DECLARAÇÃO ESCRITA DO INTERESSADO, QUE A TAL SE COMPROMETE.	<input checked="" type="checkbox"/>
É AUTORIZADA A REPRODUÇÃO PARCIAL DESTA TRABALHO (INDICAR, CASO TAL SEJA NECESSÁRIO, Nº MÁXIMO DE PÁGINAS, ILUSTRAÇÕES, GRÁFICOS, ETC.) APENAS PARA EFEITOS DE INVESTIGAÇÃO, MEDIANTE DECLARAÇÃO ESCRITA DO INTERESSADO, QUE A TAL SE COMPROMETE.	<input type="checkbox"/>
DE ACORDO COM A LEGISLAÇÃO EM VIGOR, (INDICAR, CASO TAL SEJA NECESSÁRIO, Nº MÁXIMO DE PÁGINAS, ILUSTRAÇÕES, GRÁFICOS, ETC.) NÃO É PERMITIDA A REPRODUÇÃO DE QUALQUER PARTE DESTA TRABALHO.	<input type="checkbox"/>

Faculdade de Medicina da Universidade do Porto, 02/01/2020

Assinatura conforme cartão de identificação: Daniela Alexandra Lopes Barros Ferreira Pinheiro

## IMPACT OF SARCOPENIA IN AORTO-ILIAC OCCLUSIVE DISEASE

António Pereira-Neves<sup>1,2,3</sup>, Daniela Barros<sup>3</sup>, João Rocha-Neves<sup>1,2,3</sup>, Luís Gamas<sup>2,3</sup>, Marina Dias-Neto<sup>2,3</sup>, Alfredo Cerqueira<sup>3</sup>, José Vidoedo<sup>4</sup>, José Teixeira<sup>3</sup>

1 - Department of Biomedicine – Unit of Anatomy, Faculdade de Medicina da Universidade do Porto, Portugal

2 - Department of Phisiology and Surgery, Faculdade de Medicina da Universidade do Porto, Portugal

3- Department of Angiology and Vascular Surgery, Centro Hospitalar Universitário de São João, EPE, Porto, Portugal

4 – Department of Angiology and Vascular Surgery, Centro Hospitalar do Tâmega e Sousa, EPE, Penafiel, Portugal

**Key Words:** aorto-iliac arterial occlusive disease; sarcopenia; major adverse cardiovascular events; major adverse limb events

**Word Count: 3689 (References included – annex excluded)**

### ABSTRACT

#### Introduction:

Sarcopenia is a progressive and generalised skeletal muscle disorder involving the accelerated loss of muscle mass and function that is associated with increased adverse outcomes. Psoas muscle area and density represent an analytic morphometry and an easy way to define sarcopenia.

The aim of this study was to validate these morphometric predictors in survival, in major cardiovascular and cerebrovascular events (MACCE) and in major adverse limb events (MALE) on Transatlantic Inter-Society Consensus type D (TASC D) aorto-iliac peripheral artery disease (AI-PAD) patients.

Methods: A cohort of consecutive patients undergoing revascularization of AI-PAD with lesions classified as TASC D were retrospectively included from the period of January 2013 to July 2019 at two Portuguese centers, a referral center, and a peripheral hospital. For inclusion the patient had to present a recent (<6 months) computed tomography (CT) previously to the revascularization procedure. Both centers offered to their patients open and endovascular repair of AI-PAD.

Results: In total, 57 TASC D AI-PAD patients were included. The median follow-up was 20 months (95% confidence interval [CI], 0-42.6). Survival at 30-days was  $93 \pm 3.4\%$  and at 48 months was  $62.7 \pm 8.6\%$ .

For both predictors the best discriminative threshold was obtained ( $2175.8 \text{ mm}^2$  for TPA and  $51.75 \text{ HU}$  for PMD). With these thresholds, both morphometric variables were transformed in categorical variables and longitudinal analysis was applied. Statistical significance for TPA was demonstrated, but not for PMD, for both 1-year survival ( $P=0.003$  and  $P=0.291$ , respectively) and MACCE ( $P=0.005$  and  $P=0.206$ , respectively). None showed statistical significance for MALE ( $P=0.516$  and  $P=0.313$ , respectively).

Conclusion: In this study, TPA and PMD were tested for the advantage of being less time-consuming and so, more pragmatic for clinical application. TPA demonstrated prognostic value for survival and MACCE concerning patients with TASC D AI-PAD lesions in a Mediterranean

population. It is possible that they become independently or part of a still-to-define frailty score, applicable predictors, adding not only prognostic but also possible therapeutic monitoring.

## **INTRODUCTION**

The aorto-iliac (AI) sector represents one of the biggest decisional and therapeutic challenges of the peripheral arterial disease (PAD). Since several options are available for AI-PAD treatment, contemporary therapeutic decision considers several factors further than anatomic ones. Frailty and sarcopenia are risk predictors emerging in several areas including vascular surgery since are frequent conditions among vascular patients (1, 2).

Sarcopenia is a progressive and generalised skeletal muscle disorder involving the accelerated loss of muscle mass and function that is associated with increased adverse outcomes including falls, functional decline, frailty and mortality (3). Although commonly being regarded as an age-related process, it is very frequent in life-threatening pathology (3). Psoas muscle area and density represent an analytic morphometry and an effortless way to define sarcopenia. Low total psoas area (TPA) has been associated with major complications and mortality in vascular, trauma, cancer and transplant surgery (4-12). Low psoas muscle density (PMD) is also being described as a predictor of mortality in cardiac (13), cancer (14-17) and trauma surgery (18) as well as in other pathologies (19, 20). Identifying patients at risk is an important step in the decision-making process of whether a patient would benefit from an intervention or even understand if there is any reversibility and preoperative optimization that can be provided to the patient in order to improve outcomes. However, the ongoing research and subsequent clinical utility is being challenged by different definitions and the still undisclosed optimal frailty tool to use in vascular surgery and its subpopulations.

The aim of this study was to validate these morphometric predictors in survival and in cardiovascular and cerebrovascular endpoints on extensive AI-PAD patients.

## **METHODS**

A cohort of consecutive patients undergoing revascularization of AI-PAD with lesions classified as Transatlantic Inter-Society Consensus type D lesions (TASC D) (22) (A.P.N. and J.R.N.) were retrospectively included from the period of January 2013 to July 2019 at two Portuguese centers, a referral center and a peripheral hospital. For inclusion criteria the patient had to present a recent (<6 months) computed tomography (CT) before the revascularization procedure. Both centers offered to their patients open and endovascular repair. Patients with aneurysmatic disease or other etiology rather than atherosclerosis were excluded. The study protocol was approved by the local Ethics Committee and is according to Helsinki declaration (23).

Data was obtained by an ongoing vascular registry and from detailed review of the patient's clinical records. All data regarding patients and procedure were defined according to the Society for Vascular Surgery reporting standards for lower extremity ischemic peripheral arterial disease (24).

### ***Definitions***

Major Adverse Cardiovascular and Cerebrovascular Event (MACCE) was defined as a composite outcome of stroke, myocardial infarction, coronary reintervention, acute heart

failure and all-cause death. Major Adverse Limb Event (MALE) was defined as loss of primary patency (interventions for assisted primary patency, secondary patency or loss of patency without reintervention), and major amputation.

TPA as well as PMD were assessed on CT using the program Sectra 7® (SectraMedical - Linköping, Sweden). For measurement purposes, a single cross-sectional slice at the upper level of L4 was used. The borders of the left and right psoas muscle were hand marked using the region of interest tool in mm<sup>2</sup> and the TPA constituted the sum of both areas (9). Psoas muscle density was calculated by the average of bilateral Hounsfield Units (HU) of the psoas muscle cross-sectional area. Measurements were obtained by the mean of the measurements made by two independent trained researchers (A.P.N. and L.G.) using standard graphics tools available in Sectra workstation IDS7®. Protocol was strictly followed and both researchers were blinded to previous measurements and clinical data.

For statistics purposes, SPSS (IBM Corp., released 2017. IBM SPSS Statistics for Windows, version 25.0, Armonk, NY, USA) was used. Baseline characteristics were compared using Chi-Square, Student t-test and Mann-Whitney, as appropriate. Outcome variables were expressed as Kaplan-Meier curves. Differences in baseline features were tested upon outcomes variables using log rank test. The threshold for significance was set for a P value <0.05. Risk stratification criteria were based on optimal sensitivity and specificity generated from receiver operating characteristic (ROC) curve analysis and the Youden index. Using the above-mentioned thresholds, both morphometric variables were transformed in categorical variables and longitudinal statistics was applied

The necessary sample for a two-sided test a survival test was calculated resorting to WinPepi® V11.65, aiming for a statistical power ( $\beta$ ) of 80% and an  $\alpha$ <0.05 (25). The described survival rate at 1-year follow-up is above 90% (26) for an event rate difference of 30% between groups the estimated sample was 52 patients (27).

## **RESULTS**

### *Baseline characteristics*

Table 1 summarizes the results of the demographic and clinical data from patients undergoing revascularization for aorto-iliac TASC-D lesions.

In total, 57 TASC D AI-PAD patients that underwent revascularization had a CT meeting all the inclusion criteria. Mean age was 60 ± 8.2 years old and 96% of the patients were male. Smoking (current or former smoker) (96.0%), arterial hypertension (64.9%) and dyslipidemia (64.9%) were the most prevalent cardiovascular risk factors in this population. Thirty-five patients (61.4%) presented with limb threatening ischemia (Table 1).

Open surgery was the preferred method by the surgeon with 32 (56.1%) open surgeries vs 25 patients (43.9%) who underwent endovascular therapy. Technical success in the first procedure was achieved in 51 patients (89.5%). In 5 patients with a failed endo-first approach, a later open surgery (aortobifemoral) was performed yielding a total of 56 (98.2%) successfully revascularizations. The mean ABI value increased from 0.30 ± 0.11 to 0.77 ± 0.18 after successful treatment.

### *Sarcopenia assessment*

Psoas Muscle Area ranged from 1285 to 3459 mm<sup>2</sup> with a mean ± standard deviation of 2447 ± 491.4 mm<sup>2</sup> and PMD ranged from 28.5 to 87.5 HU with a mean ± standard deviation of

50.2 ± 11.23 HU.

### *Survival*

The median follow-up was 20 months (95% confidence interval [CI], 0-42.6). Survival at 30-days was 93 ± 3.4%, at 1-year was 78% ± 6.4% and at 48 months was 62.7 ± 8.6%. By the end of follow-up 16 patients had died.

When performing ROC curves for 1-year mortality, TPA performed better comparing with PMD, obtaining an Area Under the Receiver Operating Curve (AUROC) of 0.721 (95% CI, 0.477-0.966; Figure 1) while PMD had an AUROC of 0.596 (95% CI, 0.405-0.788; Figure 1). The best discriminative threshold was obtained based on ROC curves and Youden index. For TPA the threshold was set at 2175.8 mm<sup>2</sup> with a 70% sensitivity and 89.3% specificity and for PMD was 51.75 HU with 80% sensitivity and 50% specificity.

Using the above-mentioned thresholds, both morphometric variables were transformed in categoric variables and longitudinal analysis was applied. Statistical significance for TPA (P=0.003; Figure 2) was demonstrated, but not for PMD (P=0.291; Figure 2).

TPA below threshold had a 1-year survival of 35.5 ± 15.6% and above 92.9 ± 4.0% (P=0.003) (Figure 2). PMD below threshold had a 1-year survival of 68.9 ± 9.5% while above threshold had a 1-year survival of 89.3 ± 7.2% (P=0.08) (Figure 2).

### *MACCE*

Of the studied population, during follow-up, 19 patients presented a MACCE. When performing ROC curves for 1-year MACCE, TPA was superior to PMD as a morphometric predictor, obtaining an AUROC of 0.702 CI 95% [0.477 – 0.928] (P=0.045) while PMD had an AUROC of 0.592 CI 95% [0.406 – 0.77] (p=0.360) (Figure 1).

The TPA scoring point was once again 2175 mm<sup>2</sup> with 67% sensitivity and 89.3% specificity. For PMD the threshold was 51.7 HU, with 75% sensitivity and 53.6% specificity. Statistical significance for TPA (P=0.005) (Figure 2) was demonstrated, but not for PMD (P=0.206) (Figure 2).

TPA below threshold had an 18-month survival of 32.6 ± 14.7% and above 90.5 ± 4.5%. PMD below threshold had an 18-month survival of 67.1 ± 9.4% while above threshold had an 18-month survival of 85.6 ± 7.8%.

### *MALE*

Of the studied population, there were 14 MALE events. ROC curves for 1-year MALE showed poor prediction ability for both TPA (AUROC of 0.583 [95% CI, 0.366-0.799]) (Figure 1) and PMD (AUROC of 0.55 [95% CI, 0.326-0.773]) (Figure 1). Concerning MALE thresholds, ROC analysis was also performed. For TPA, 2449 mm<sup>2</sup> demonstrated the best performance with 63.9% sensitivity and 54.5% specificity while for PMD, 45.5 HU was the best cut off point with 54.5% sensitivity and 63.6% specificity.

Using the Kaplan Meier method with the categoric variables obtained by ROC curve analysis, no statistical significance either for TPA (P=0.516) (Figure 2) or PMD (P=0.313) (Figure 2) was found.



### *Length of stay*

Neither TPA (P=0.557 and P=0.734, respectively) or PMD (P=0.331 and P=0.447, respectively) were associated with the length of stay in nursery or intensive care unit.

## **DISCUSSION**

In this study, TPA and PMD were tested for the advantage of being less time-consuming and more pragmatic for clinical application. Furthermore, despite being important prognostic markers, the literature presents a gap regarding the threshold of morphometric parameters to define sarcopenia consistently or the risk patients. In this study, TPA < 2175 mm<sup>2</sup> was validated has a diagnostic cut-off for this Mediterranean population, mainly composed of male patients.

While TPA reflects frailty and a propensity towards lower functional status, PMD reflects frailty with a close relationship to patient nutritional status (28), as also higher densities were related with lower inflammatory markers (29). Literature about PMD is scarce compared to TPA, inclusively in vascular surgery. A lack of universal thresholds for defining low PMA and PMD and substantial differences in the measurements across the included studies are the main challenges to PMA and PMD use as stated before.

Chowdhury et al.(30) tested different morphometric predictors including TPA and PMD in older vascular surgery patients, and concluded that TPA was significantly associated with readmission-free survival but no statistical significant result concerning PMD was detected. TPA is validated for abdominal aortic aneurysms (5, 31) and with growing literature concerning peripheral arterial disease (1, 9). Nowadays is considered a frailty tool with moderate quality and capable of predicting long-term survival after major vascular surgery (32). These studies corroborate the previous evidence available in other surgical fields, revealing higher risk of mortality for lower TPA (6, 11, 14, 16).

Neither TPA or PMD revealed statistical significance for MALE (P=0.516 and P=0.313, respectively). In previous studies, PMD also failed to achieve statistical significance with PAD severity or amputation free survival .

Several clinical applications are evident from the results of this study. First, TPA was validated as survival and MACCE predictor concerning patients with aorto-iliac TASC D lesions in a Mediterranean population. Sarcopenia does not imply non-operability but rather tailored planning for this group, with careful perioperative interventions. Therefore, frailty should be regarded as a therapeutic target with peri-operative management and close monitoring and follow-up. In order to slowdown frailty and sarcopenic progression, multiple interventions are advised such as nutritional intervention, physical rehabilitation and planned discharge with home assistance, although still with poor supporting evidence (34, 35). Second, these predictors, mainly TPA, present the advantage of being ready collectable alongside with the increase number of CTAs as part of medical investigation. It is possible that they become independently or part of a still-to-define frailty score, adding not only prognostic but also possible therapeutic monitoring (36, 37).

### *Limitations*

Being a two-institution retrospective cohort, several limitations arise. Selection bias was present since the frailest patients might were deemed non-eligible for revascularization. Another major limitation arising from selection bias, is the fact that in this cohort, patients with iliac stent had smaller areas. External validity is limited due to the specificity of this subset of

patients. Although efforts were made to minimize missing data, 44% of patients were excluded because of missing CTs largely from peripheral hospitals that drained the patients to the referral center, which were not uploaded to the electronic system. Furthermore, it is possible that different cut-off values regarding gender may apply (38), although this was not addressed in this study, since the sample is mainly composed of males.

These limitations aside, this study provides a useful evaluation of growing literature on sarcopenia as a predictor of outcomes in vascular surgery.

## **CONCLUSION**

In this study, TPA demonstrated prognostic value for survival and MACCE concerning patients with aorto-iliac TASC D lesions while allowing fast straightforward assessment with reproducibility. However, neither TPA or PMD revealed statistical significance for MALE. This study adds to the growing literature on sarcopenia as a predictor of outcomes in vascular surgery and should be seen as a stimulus for further research to achieve the full potential of these markers in the guidance for clinical decision, patient counseling on operative risk and management of perioperative interventions by multidisciplinary teams in order to improve outcomes.

## **Acknowledgements**

Nothing to report.

## **Funding**

Nothing to declare.

## **References**

1. Reeve T, Ur R, Craven TE, Kaan JH, Goldman MP, Edwards MS, et al. Grip strength measurement for frailty assessment in patients with vascular disease and associations with comorbidity, cardiac risk, and sarcopenia. *J Vasc Surg.* 2018;67(5):1512-20.
2. Ghaffarian AA, Foss WT, Donald G, Kraiss LW, Sarfati M, Griffin CL, et al. Prognostic implications of diagnosing frailty and sarcopenia in vascular surgery practice. *J Vasc Surg.* 2019.
3. Cruz-Jentoft AJ, Sayer AA. Sarcopenia. *Lancet.* 2019.
4. Amini N, Spolverato G, Gupta R, Margonis GA, Kim Y, Wagner D, et al. Impact Total Psoas Volume on Short- and Long-Term Outcomes in Patients Undergoing Curative Resection for Pancreatic Adenocarcinoma: a New Tool to Assess Sarcopenia. *J Gastrointest Surg.* 2015;19(9):1593-602.
5. Drudi LM, Phung K, Ades M, Zuckerman J, Mullie L, Steinmetz OK, et al. Psoas Muscle Area Predicts All-Cause Mortality After Endovascular and Open Aortic Aneurysm Repair. *Eur J Vasc Endovasc Surg.* 2016;52(6):764-9.
6. Englesbe MJ, Patel SP, He K, Lynch RJ, Schaubel DE, Harbaugh C, et al. Sarcopenia and mortality after liver transplantation. *J Am Coll Surg.* 2010;211(2):271-8.
7. Haymana C, Safer U. Measurement of cross-sectional area of the psoas for sarcopenia. *Colorectal Dis.* 2015;17(2):172.
8. Jones KI, Doleman B, Scott S, Lund JN, Williams JP. Simple psoas cross-sectional area measurement is a quick and easy method to assess sarcopenia and predicts major surgical complications. *Colorectal Dis.* 2015;17(1):O20-6.

9. Juszczak MT, Taib B, Rai J, Iazzolino L, Carroll N, Antoniou GA, et al. Total psoas area predicts medium-term mortality after lower limb revascularization. *J Vasc Surg.* 2018.
10. Lyon TD, Farber NJ, Chen LC, Fuller TW, Davies BJ, Gingrich JR, et al. Total Psoas Area Predicts Complications following Radical Cystectomy. *Adv Urol.* 2015;2015:901851.
11. Mamane S, Mullie L, Piazza N, Martucci G, Morais J, Vigano A, et al. Psoas Muscle Area and All-Cause Mortality After Transcatheter Aortic Valve Replacement: The Montreal-Munich Study. *Can J Cardiol.* 2016;32(2):177-82.
12. Harada K, Suzuki S, Ishii H, Aoki T, Hirayama K, Shibata Y, et al. Impact of Skeletal Muscle Mass on Long-Term Adverse Cardiovascular Outcomes in Patients With Chronic Kidney Disease. *Am J Cardiol.* 2017;119(8):1275-80.
13. Yamashita M, Kamiya K, Matsunaga A, Kitamura T, Hamazaki N, Matsuzawa R, et al. Prognostic Value of Psoas Muscle Area and Density in Patients Who Undergo Cardiovascular Surgery. *Can J Cardiol.* 2017;33(12):1652-9.
14. Miller BS, Ignatoski KM, Daignault S, Lindland C, Doherty M, Gauger PG, et al. Worsening central sarcopenia and increasing intra-abdominal fat correlate with decreased survival in patients with adrenocortical carcinoma. *World J Surg.* 2012;36(7):1509-16.
15. Joglekar S, Asghar A, Mott SL, Johnson BE, Button AM, Clark E, et al. Sarcopenia is an independent predictor of complications following pancreatectomy for adenocarcinoma. *J Surg Oncol.* 2015;111(6):771-5.
16. Chakedis J, Spolverato G, Beal EW, Woelfel I, Bagante F, Merath K, et al. Pre-operative Sarcopenia Identifies Patients at Risk for Poor Survival After Resection of Biliary Tract Cancers. *J Gastrointest Surg.* 2018.
17. Margadant CC, Bruns ER, Sloothaak DA, van Duijvendijk P, van Raamt AF, van der Zaag HJ, et al. Lower muscle density is associated with major postoperative complications in older patients after surgery for colorectal cancer. *Eur J Surg Oncol.* 2016;42(11):1654-9.
18. Yoo T, Lo WD, Evans DC. Computed tomography measured psoas density predicts outcomes in trauma. *Surgery.* 2017;162(2):377-84.
19. Kalafateli M, Karatzas A, Tsiaoussis G, Koutroumpakis E, Tselekouni P, Koukias N, et al. Muscle fat infiltration assessed by total psoas density on computed tomography predicts mortality in cirrhosis. *Ann Gastroenterol.* 2018;31(4):491-8.
20. Buse GL, Manns B, Lamy A, Guyatt G, Polanczyk CA, Chan MTV, et al. Troponin T monitoring to detect myocardial injury after noncardiac surgery: a cost-consequence analysis. *Canadian journal of surgery Journal canadien de chirurgie.* 2018;61(3):185-94.
21. Swanson S, Patterson RB. The correlation between the psoas muscle/vertebral body ratio and the severity of peripheral artery disease. *Ann Vasc Surg.* 2015;29(3):520-5.
22. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *Eur J Vasc Endovasc Surg.* 2007;33 Suppl 1:S1-75.
23. Rocha-Neves J, Ferreira A, Sousa J, Pereira-Neves A, Vidoedo J, Alves H, et al. Endovascular Approach Versus Aortobifemoral Bypass Grafting: Outcomes in Extensive Aortoiliac Occlusive Disease. *Vasc Endovascular Surg.* 2019:1538574419888815.
24. Stoner MC, Calligaro KD, Chaer RA, Dietzek AM, Farber A, Guzman RJ, et al. Reporting standards of the Society for Vascular Surgery for endovascular treatment of chronic lower extremity peripheral artery disease. *J Vasc Surg.* 2016;64(1):e1-e21.
25. Abramson JH. WINPEPI (PEPI-for-Windows): computer programs for epidemiologists. *Epidemiol Perspect Innov.* 2004;1(1):6.
26. Zamor KC, Hoel AW, Helenowski IB, Beck AW, Schneider JR, Ho KJ. Comparison of Direct and Less Invasive Techniques for the Treatment of Severe Aorto-Iliac Occlusive Disease. *Ann Vasc Surg.* 2018;46:226-33.
27. Aboyans V, Kakisis Y. Myocardial Injury After Non-cardiac Surgery: What this "MINS" for the Vascular Surgeon? *Eur J Vasc Endovasc Surg.* 2018;56(2):161-2.

28. Yeh DD, Ortiz-Reyes LA, Quraishi SA, Chokengarmwong N, Avery L, Kaafarani HMA, et al. Early nutritional inadequacy is associated with psoas muscle deterioration and worse clinical outcomes in critically ill surgical patients. *J Crit Care*. 2018;45:7-13.
29. RB VANH, Cushman M, Schlueter EF, Allison MA. Abdominal Muscle Density Is Inversely Related to Adiposity Inflammatory Mediators. *Med Sci Sports Exerc*. 2018;50(7):1495-501.
30. Chowdhury MM, Ambler GK, Al Zuhir N, Walker A, Atkins ER, Winterbottom A, et al. Morphometric Assessment as a Predictor of Outcome in Older Vascular Surgery Patients. *Ann Vasc Surg*. 2018;47:90-7.
31. Indrakusuma R, Zijlmans JL, Jalalzadeh H, Planken RN, Balm R, Koelemay MJW. Psoas Muscle Area as a Prognostic Factor for Survival in Patients with an Asymptomatic Infrarenal Abdominal Aortic Aneurysm: A Retrospective Cohort Study. *Eur J Vasc Endovasc Surg*. 2018;55(1):83-91.
32. Wang J, Zou Y, Zhao J, Schneider DB, Yang Y, Ma Y, et al. The Impact of Frailty on Outcomes of Elderly Patients After Major Vascular Surgery: A Systematic Review and Meta-analysis. *Eur J Vasc Endovasc Surg*. 2018.
33. Nyers ES, Brothers TE. Perioperative psoas to lumbar vertebral index does not successfully predict amputation-free survival after lower extremity revascularization. *J Vasc Surg*. 2017;66(6):1820-5.
34. Indrakusuma R, Drudi LM. Psoas Muscle Area and Sarcopenia - Bridging the Gap. *Eur J Vasc Endovasc Surg*. 2019.
35. Drudi LM, Ades M, Landry T, Gill HL, Grenon SM, Steinmetz OK, et al. Scoping review of frailty in vascular surgery. *J Vasc Surg*. 2019;69(6):1989-98 e2.
36. Marzetti E, Calvani R, Tosato M, Cesari M, Di Bari M, Cherubini A, et al. Sarcopenia: an overview. *Aging Clin Exp Res*. 2017;29(1):11-7.
37. Bosaeus I, Rothenberg E. Nutrition and physical activity for the prevention and treatment of age-related sarcopenia. *Proc Nutr Soc*. 2016;75(2):174-80.
38. Matsubara Y, Matsumoto T, Aoyagi Y, Tanaka S, Okadome J, Morisaki K, et al. Sarcopenia is a prognostic factor for overall survival in patients with critical limb ischemia. *J Vasc Surg*. 2015;61(4):945-50.
39. Visser L, Banning LBD, El Moumni M, Zeebregts CJ, Pol RA. The Effect of Frailty on Outcome After Vascular Surgery. *Eur J Vasc Endovasc Surg*. 2019;58(5):762-9.

ATTACHMENT

Table 1 – Demographic and clinical data from patients undergoing revascularization for aorto-iliac TASC D lesions.

Variables	n=57
<i>Demographics</i>	
Age (years), mean ± SD	60 ± 8.2
Sex (male), n (%)	55 (96)
<i>Cardiovascular risk factors</i>	
HTN, n (%)	37 (64.9)
Smoking, n (%)	55 (96)
CKD, n (%)	7 (12.3)
DM, n (%)	19 (33.3)
Dyslipidemia, n (%)	37 (64.9)
<i>Comorbidities</i>	
CAD, n (%)	14 (24.6)
CHF, n (%)	4 (7)
COPD, n (%)	5 (8.8)
Functional Status, n (%)	
Dependent	0
Partially Dependent	4 (7)
Independent	53 (93)
ASA, mean ± SD	2,6 ± 0.59
<i>Limb status</i>	
Rutherford, n (%)	
3	17 (29.8)
4	27 (47.4)
5	9 (15.8)
6	3 (5.3)
Limb threatening ischemia, n (%)	35 (61.4)
<i>Intervention</i>	
Open, n (%)	32 (56.1)
Endo, n (%)	25 (43.9)

Legend: SD – standard deviation; HTN – Hypertension; CKD (creat>1.5mg/dl); DM – Diabetes Mellitus;

CAD – Coronary Arterial Disease; CHF – Chronic Heart Failure; COPD - Chronic Obstructive Pulmonary

Disease; ASA – American Society of Anesthesiologists Classification

## FIGURES

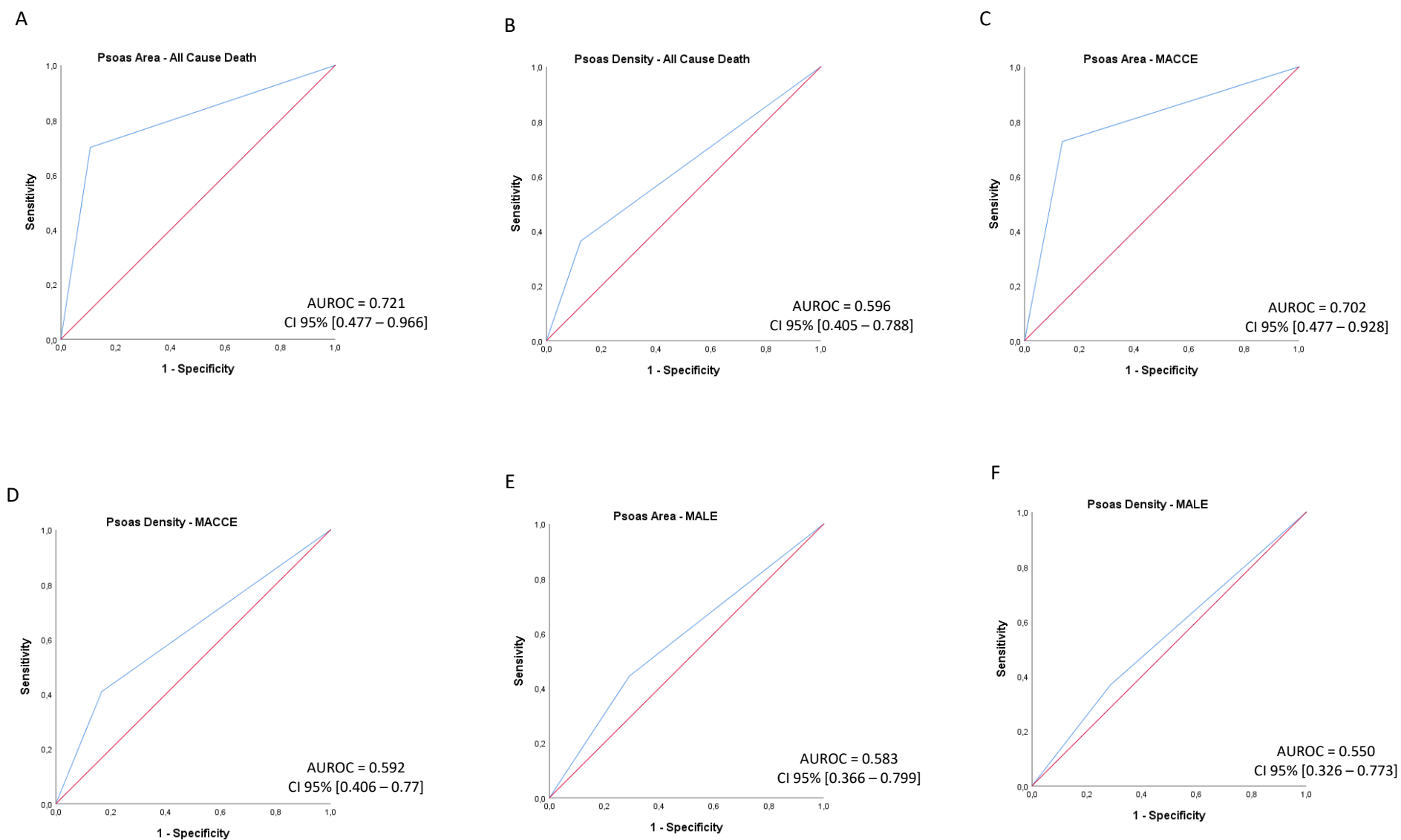
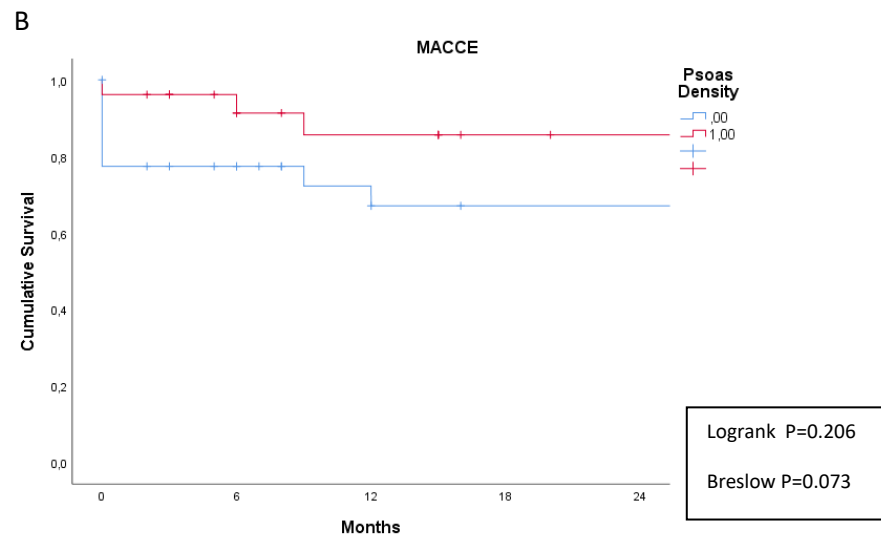
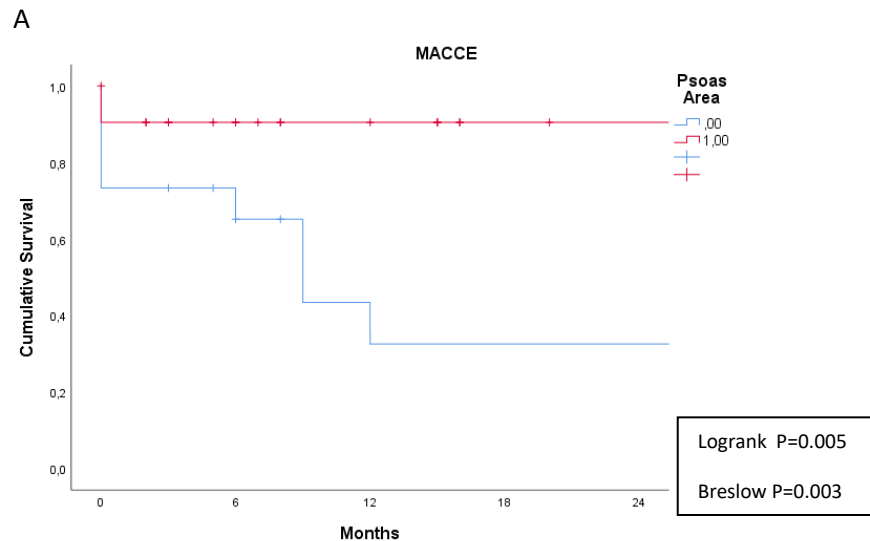


Figure 1 – A. ROC curves for 1-year mortality for TPA. B. ROC curves for 1-year mortality for PMD. C. ROC curves for MACCE for TPA. D. ROC curves for MACCE for PMD. E. ROC curves for MALE for TPA. F. ROC curves for MALE for PMD.

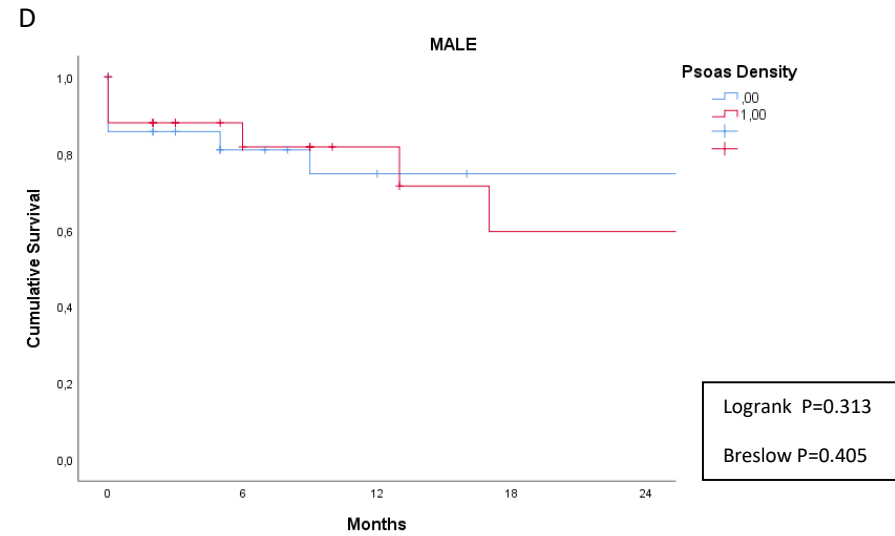
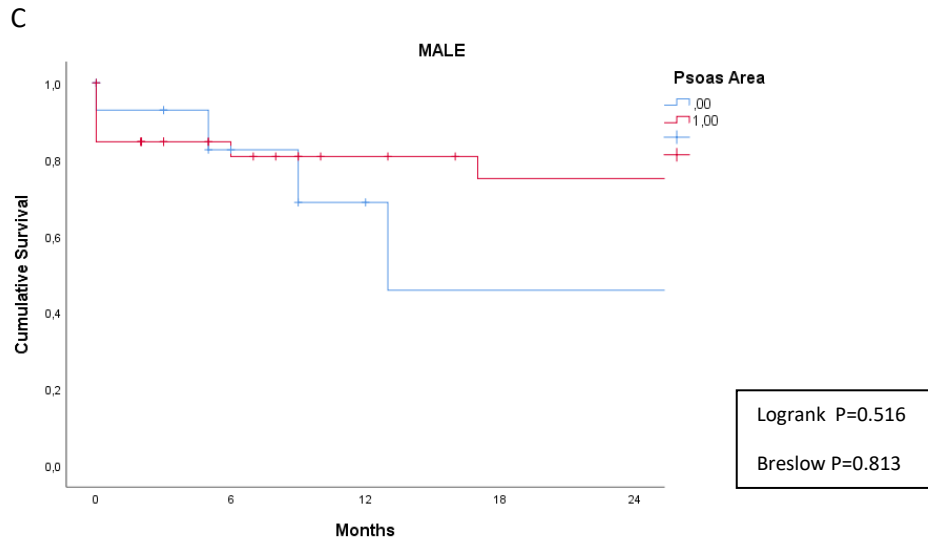
AUROC - Area Under the Receiver Operating Curve

MACE – Major Adverse Cardiovascular Event, MALE – Major Adverse Limb Event, TPA – Total Psoas Area, PMD – Psoas Muscle Density.



Time (months)		1	6	12	18
Total psoas area < 2175 mm <sup>2</sup>	Survival (%)	73.3	65.2	32.6	32.6
	SE (%)	11.4	12.7	14.7	14.7
	Under FU (n)	11	7	3	3
	Cumulative events (n)	4	5	8	8
Total psoas area > 2175 mm <sup>2</sup>	Survival (%)	90.5	90.5	90.5	90.5
	SE (%)	4.5	4.5	4.5	4.5
	Under FU (n)	37	37	37	37
	Cumulative events (n)	4	4	4	4

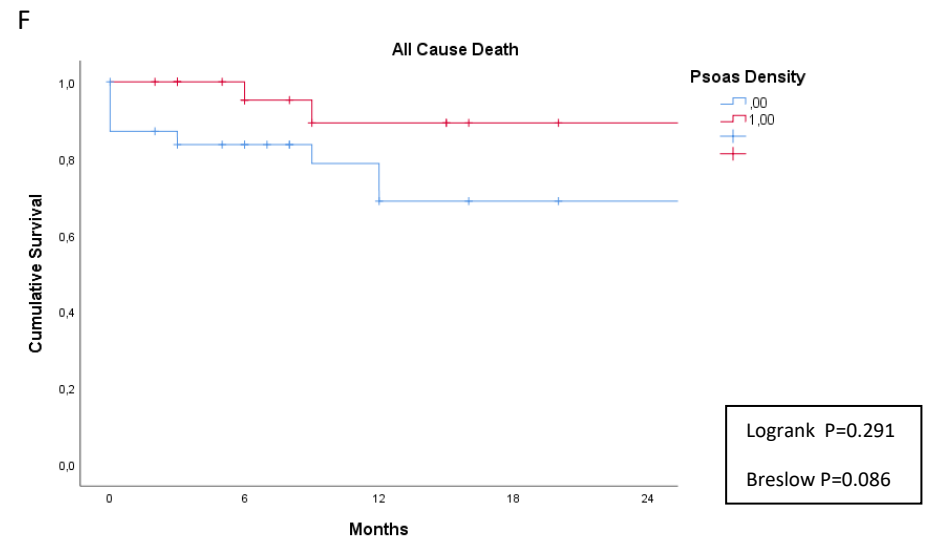
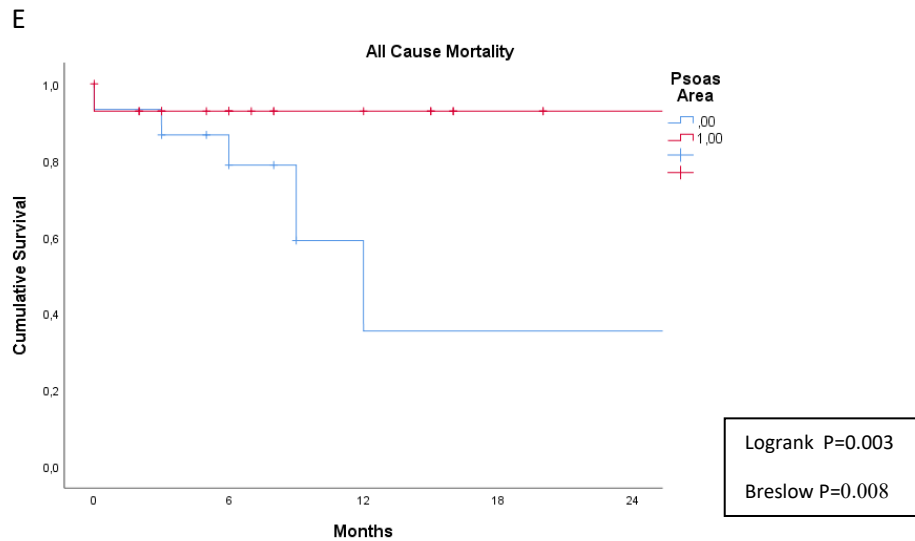
Time (months)		1	6	12	18
Psoas Muscle density < 51.7 HU	Survival (%)	77.4	77.4	67.1	67.1
	SE (%)	7.5	7.5	9.4	9.4
	Under FU (n)	23	18	12	11
	Cumulative events (n)	7	7	9	9
Psoas Muscle density > 51.7 HU	Survival (%)	96.2	91.3	85.6	85.6
	SE (%)	3.8	5.9	7.8	7.8
	Under FU (n)	25	19	15	11
	Cumulative events (n)	1	2	3	3



Time (months)		1	6	12	18
Total psoas area < 2175 mm <sup>2</sup>	Survival (%)	89.3	78.4	71.3	62.4
	SE (%)	5.8	8.8	10.5	12.4
	Under FU (n)	23	13	8	7
	Cumulative events (n)	3	5	6	7
Total psoas area > 2175 mm <sup>2</sup>	Survival (%)	84	84	84	74.7
	SE (%)	7.3	7.3	7.3	11
	Under FU (n)	20	14	11	8
	Cumulative events (n)	4	4	4	5

Time (months)		1	6	12	18
Psoas density < 51.7 HU	Survival (%)	83.3	76.4	67.9	67.9
	SE (%)	8.8	10.4	12.3	12.3
	Under FU (n)	14	9	8	7
	Cumulative events (n)	3	4	5	5
Psoas density > 51.7 HU	Survival (%)	88.6	84.1	84.1	68
	SE (%)	5.4	6.7	6.7	11.6
	Under FU (n)	29	18	11	8
	Cumulative events (n)	4	5	5	7





Time (months)		1	6	12
Total psoas area < 2175 mm <sup>2</sup>	Survival (%)	93.3	78.8	35.5
	SE (%)	6.4	11.0	15.6
	Under FU (n)	14	10	3
	Cumulative events (n)	1	3	7
Total psoas area > 2175 mm <sup>2</sup>	Survival (%)	92.9	92.9	92.9
	SE (%)	4.0	4.0	4.0
	Under FU (n)	38	28	24
	Cumulative events (n)	3	3	3

Time (months)		1	6	12	18
Psoas Muscle density < 51.7 HU	Survival (%)	87.1	83.6	68.9	68.9
	SE (%)	6.0	6.7	9.5	9.5
	Under FU (n)	36	21	13	12
	Cumulative events (n)	4	5	8	8
Psoas Muscle density > 51.7 HU	Survival (%)	95.2	95.2	89.3	89.3
	SE (%)	4.6	4.6	7.2	7.2
	Under FU (n)	25	17	14	11
	Cumulative events (n)	0	1	2	2

Figure 2 - Survival plots. 12 and 18 months follow-up Kaplan Meier survival plots for different clinical events post- Aorto-iliac revascularization, for Total Psoas Area and Psoas Muscle Density. A – MACCE for total Psoas Area; B MACCE for Psoas Muscle Density; C–MALE for total Psoas Area; D - MALE for Psoas Muscle Density; F –All-cause Death for Psoas Muscle Area; G – All-cause Death for Psoas Muscle Density. MACCE – Major Adverse Cardiovascular and Cerebrovascular Event; MALE – Major Adverse Limb Event



# JOURNAL OF SURGICAL RESEARCH

A Journal of Surgical Basic Science, Clinical Investigation, Outcome Studies and Education Research

Official Publication of the [Association for Academic Surgery](#)

## AUTHOR INFORMATION PACK

### TABLE OF CONTENTS

●	<b>Description</b>	<b>p.1</b>
●	<b>Impact Factor</b>	<b>p.1</b>
●	<b>Abstracting and Indexing</b>	<b>p.1</b>
●	<b>Editorial Board</b>	<b>p.1</b>
●	<b>Guide for Authors</b>	<b>p.4</b>



ISSN: 0022-4804

### DESCRIPTION

The *Journal of Surgical Research: Clinical and Laboratory Investigation* publishes original articles concerned with clinical and laboratory investigations relevant to **surgical practice** and **teaching**. The journal emphasizes reports of clinical investigations or fundamental research bearing directly on **surgical management** that will be of general interest to a broad range of surgeons and surgical researchers. The articles presented need not have been the products of surgeons or of surgical laboratories.

The *Journal of Surgical Research* also features review articles and special articles relating to educational, research, or social issues of interest to the academic surgical community.

#### Benefits to authors

We also provide many author benefits, such as free PDFs, a liberal copyright policy, special discounts on Elsevier publications and much more. Please click here for more information on our [author services](#).

Please see our [Guide for Authors](#) for information on article submission. If you require any further information or help, please visit our [Support Center](#)

### IMPACT FACTOR

2018: 1.872 © Clarivate Analytics Journal Citation Reports 2019

### ABSTRACTING AND INDEXING

Scopus

### EDITORIAL BOARD

#### Editor

**Scott LeMaire**, Baylor College of Medicine, Houston, Texas, United States

#### Associate Editors

**Suresh Agarwal**, University of Wisconsin Madison School of Medicine and Public Health

**Malcolm Brock**, JOHNS HOPKINS UNIVERSITY

**Dawn M. Coleman**, University of Michigan  
**Anne Fischer**, Oakland University  
**Amir Ghaferi**, University of Michigan  
**Weidun Alan Guo**, University at Buffalo - The State University of New York  
**Nader Massarweh**, Baylor College of Medicine  
**Benedict Nwomeh**, OHIO STATE UNIVERSITY  
**Roy Phitayakorn**, Massachusetts General Hospital, Education and Career Development  
**Dino J. Ravnich**, Pennsylvania State University Division of Plastic Surgery  
**David F. Schneider**, University of Wisconsin Madison School of Medicine and Public Health  
**Craig Selzman**, The University of Utah  
**Rebecca Sippel**, University of Wisconsin Madison School of Medicine and Public Health  
**Kazuaki Takabe**, Roswell Park Cancer Institute  
**Jose Trevino**, University of Florida Health Science Center  
**Christoph Troppmann**, University of California Davis  
**Catherine Garrison Velopulos**, University of Colorado Denver - Anschutz Medical Campus  
**James Yoo**, Brigham and Women's Hospital Department of Surgery

***Social Media Editor***

**Niraj J. Gusani**, Penn State Cancer Institute

***Statistics Editor***

**Mazen S. Zenati**, University of Pittsburgh

***Association for Academic Surgery Publications Committee co-Chairs***

**Luke Funk**, University of Wisconsin Madison School of Medicine and Public Health

**Michael Goodman**, University of Cincinnati

***Society for Asian Academic Surgeons Publications Committee Chair***

**Ash Gosain**, University of Tennessee

***Society of Asian Academic Surgeons Program Committee Chair***

**Jennifer Kuo**, Columbia University Department of Surgery

***Managing Editor***

**S. Newcombe**, Stellar Medical Publications, Plymouth, Massachusetts, United States

***Editorial Board***

**Vatche Agopian**, University of California Los Angeles David Geffen School of Medicine

**Christopher Anderson**, University of Mississippi Medical Center

**Avo Artinyan**, Baylor College of Medicine

**Rebecca Auer**, Ottawa Hospital

**Courtney Balentine**, VA North Texas Health Care System

**Peyman Benharash**, University of California Los Angeles

**Ankit Bharat**, Northwestern University Feinberg School of Medicine

**Cherif Boutros**, UNIVERSITY OF MARYLAND MEDICAL CENTER

**Michael Bowdish**, University of Southern California

**Scott C. Brakenridge**, University of Florida

**Luke Brewster**, Emory University School of Medicine

**Ernest Camp**, University of South Carolina

**Evie Carchman**, University of Wisconsin Madison

**Andrew Chen**, University of Connecticut

**Daniel I. Chu**, University of Alabama at Birmingham

**Mashaal Dhir**, State University of New York Upstate Medical University

**Michael DiMaio**, Baylor Scott and White Health

**Nicholas Garguilo, III**, Brookdale University Hospital and Medical Center

**Sean Glasgow**, Washington University in Saint Louis

**Jason S. Gold**, Brigham and Women's Hospital

**Michael Goodman**, University of Cincinnati

**David Gourlay**, Medical College of Wisconsin

**Jacob Greenberg**, University of Wisconsin Madison School of Medicine and Public Health

**Imran Hassan**, University of Iowa Department of Surgery

**Andrew Hill**, The University of Auckland

**Christine Hwang**, UNIVERSITY OF TEXAS SOUTHWESTERN MEDICAL CENTER

**Angela M. Ingraham**, University of Wisconsin Madison

**Hikomichi Ito**, Cancer Institute Hospital Gastroenterology Center

**Ajay Jain**, State University of New York

**Benjamin C. James**, Harvard Medical School, Beth Israel Deaconess Medical Center

**Jing Ji**, University of Pittsburgh

**Hee Soo Jung**, University of Wisconsin Madison School of Medicine and Public Health  
**Haytham Kaafarani**, Massachusetts General Hospital, Dept. of Surgery  
**Muneera Kapadia**, University of Iowa  
**Sandeep Keswani**, Baylor College of Medicine  
**Roger H. Kim**, Southern Illinois University School of Medicine  
**Sanjay Krishnaswami**, Oregon Health & Science University  
**Peter Learn**, Uniformed Services University of the Health Sciences  
**Michael Leitman**, BETH ISRAEL MEDICAL CENTER  
**Michael Lowe**, Emory University School of Medicine  
**Ajay V. Maker**, University of Illinois at Chicago  
**Amy Makley**, University of Cincinnati  
**Colin Martin**, University of Alabama at Birmingham  
**Matthew Martin**, Madigan Army Medical Center  
**Stephan McKellar**, The University of Utah  
**Kevin Mollen**, Children's Hospital of Pittsburgh of UPMC  
**Chet Morrison**, LANCASTER GENERAL HEALTH SYSTEM  
**Peter Muscarella II**, Montefiore Medical Center  
**Peter Nau**, University of Iowa  
**Giuseppe Nigri**, University of Rome La Sapienza  
**Vanessa Nomellini**, University of Cincinnati Medical Center  
**Terence O'Keefe**, The University of Arizona Health Sciences  
**Michael Shay O'Mara**, OHIO STATE UNIVERSITY  
**Nicholas H. Osborne**, University of Michigan  
**Jacquelyn Quin**, VA Boston Healthcare System  
**Randall Scheri**, Duke University  
**Soman Sen**, University of California Davis Department of Surgery  
**Brian Shames**, University of Connecticut  
**Jason Sicklick**, University of California San Diego  
**Eric Silberfein**, Baylor College of Medicine  
**Courtney Sommer**, Duke University  
**William Stansfield**, University of Toronto  
**Pasithorn A. Suwanabol**, University of Michigan  
**Barbara W. Trautner**, Baylor College of Medicine  
**Peter I. Tsai**, University of Hawai'i at Manoa  
**Georgios Tsoulfas**, Aristotle University of Thessaloniki  
**Tracy S. Wang**, Medical College of Wisconsin  
**Heather Yeo**, Weill Cornell Medicine  
**Steven Yule**, Brigham and Women's Hospital  
**Ali Zarrinpar**, University of California Los Angeles  
**Victor M. Zaydfudim**, University of Virginia  
**Amer Zureikat**, University of Pittsburgh

***Previous Editors***

**Charles Child, III**, 1961-1966  
**George D. Zuidema**, 1967-1972  
**David B. Skinner**, 1972 -1982  
**Christopher K. Zarins**, 1983-1995  
**Bruce L. Gewertz**, 1990-1997  
**Wiley Souba**, 1996-2015  
**David McFadden**, 1998-2016

## GUIDE FOR AUTHORS

---

### INTRODUCTION

The *Journal of Surgical Research* publishes original manuscripts dealing with clinical and laboratory investigations pertinent to the practice and teaching of surgery. Priority will be given to reports of clinical investigations or basic research bearing directly on surgical management, and of general interest to a wide range of surgeons and surgical investigators. Manuscripts relating to surgical specialty interests will be judged on the basis of general interest. Research need not have been done by surgeons or in surgical laboratories. The *Journal* publishes review articles and special articles relating to educational, research, or social issues pertinent to the academic surgical community. Such manuscripts should be designated as *Research Review* or *Special Article* in the cover letter, as well as on the title page. Preliminary reports of 1000 words or less which are accepted by the editorial board will be given priority for the earliest possible publication.

### Submission of Manuscripts

It is a condition of publication that all manuscripts must be submitted in English to the Journal of Surgical Research submission and review Website, [ees.elsevier.com/jsurgres/](https://ees.elsevier.com/jsurgres/). Authors are requested to transmit the text and art of the manuscript in electronic form to this address. Each manuscript must also be accompanied by a cover letter outlining the basic findings of the paper and their significance. Minimal exceptions will be exercised. Should you be unable to provide an electronic version, please contact the editorial office prior to submission by e-mail: [JSR@stellarmed.com](mailto:JSR@stellarmed.com); Tel.: 508-732-6767 (x14); or fax: 508-732-6766.

### Page charges

This journal has no page charges.

### Submission checklist

You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

### Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:

- E-mail address
- Full postal address

All necessary files have been uploaded:

#### Manuscript:

- Include keywords
- All figures (include relevant captions)
- All tables (including titles, description, footnotes)
- Ensure all figure and table citations in the text match the files provided
- Indicate clearly if color should be used for any figures in print

*Graphical Abstracts / Highlights files* (where applicable)

*Supplemental files* (where applicable)

Further considerations

- Manuscript has been 'spell checked' and 'grammar checked'
- All references mentioned in the Reference List are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources (including the Internet)
- A competing interests statement is provided, even if the authors have no competing interests to declare
- Journal policies detailed in this guide have been reviewed
- Referee suggestions and contact details provided, based on journal requirements

For further information, visit our [Support Center](#).

### BEFORE YOU BEGIN

#### Ethics in publishing

Please see our information pages on [Ethics in publishing](#) and [Ethical guidelines for journal publication](#).

Submitted manuscripts may be screened by one of several electronic programs for overlap in content or writing with published articles.

The policies and procedures for Journal of Surgical Research generally follow those of the International Committee of Medical Journal Editors, as published in the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication" (updated December 2015; <http://www.icmje.org>).

Manuscripts are considered for publication if and only if the article and its key features (1) are not under consideration elsewhere, (2) have not been published, and (3) will not appear in print or online prior to appearing in Journal of Surgical Research. This restriction does not apply to abstracts or posters published in connection with scientific meetings; in addition, press reports arising from a conference will not be considered prior publication, provided that authors who discuss their conference presentation or poster with reporters are careful not to offer more detail about their work than was contained in the oral or poster presentation.

Submission of a manuscript is understood to indicate that the authors have complied with all policies as delineated in this document. Individuals who violate these policies are subject to editorial action including but not limited to (1) being prohibited from submitting manuscripts to the journal, (2) disclosure of violations to employers, funding agencies, professional organizations, or other journal offices, and/or (3) publication of a retraction, correction, editorial expression of concern, or editorial.

When a manuscript is received by Journal of Surgical Research that has an author who is also the Editor-in-Chief of the journal, or is from the Editor-in-Chief's institution, that Editor will recuse himself from any editorial responsibilities for the manuscript. In addition, individuals who have potential conflicts of interest with any manuscript sent to them for review will be asked to recuse themselves from serving as peer reviewers.

### **Studies in humans and animals**

If the work involves the use of human subjects, the author should ensure that the work described has been carried out in accordance with [The Code of Ethics of the World Medical Association \(Declaration of Helsinki\)](#) for experiments involving humans. The manuscript should be in line with the [Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals](#) and aim for the inclusion of representative human populations (sex, age and ethnicity) as per those recommendations. The terms [sex and gender](#) should be used correctly.

Authors should include a statement in the manuscript that informed consent was obtained for experimentation with human subjects. The privacy rights of human subjects must always be observed.

All animal experiments should comply with the [ARRIVE guidelines](#) and should be carried out in accordance with the U.K. Animals (Scientific Procedures) Act, 1986 and associated guidelines, [EU Directive 2010/63/EU for animal experiments](#), or the National Institutes of Health guide for the care and use of Laboratory animals (NIH Publications No. 8023, revised 1978) and the authors should clearly indicate in the manuscript that such guidelines have been followed. The sex of animals must be indicated, and where appropriate, the influence (or association) of sex on the results of the study.

### **Declaration of interest**

All authors must disclose any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work. Examples of potential competing interests include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. Authors must disclose any interests in two places: 1. A summary declaration of interest statement in the title page file (if double-blind) or the manuscript file (if single-blind). If there are no interests to declare then please state this: 'Declarations of interest: none'. This summary statement will be ultimately published if the article is accepted. 2. Detailed disclosures as part of a separate Declaration of Interest form, which forms part of the journal's official records. It is important for potential interests to be declared in both places and that the information matches. [More information](#).

Authors are required to disclose commercial or similar relationships to products or companies mentioned in or related to the subject matter of the article being submitted. Sources of funding for the article should be acknowledged. Affiliations of authors should include corporate appointments relating to or in connection with products or companies mentioned in the article, or otherwise bearing

on the subject matter thereof. Other pertinent financial relationships, such as consultancies, stock ownership or other equity interests or patent-licensing arrangements, should be disclosed to the Editor-in-Chief in the cover letter at the time of submission, and this information should also be listed in the manuscript's Disclosure section, which appears before the Reference section. Questions about this policy should be directed to the Editor-in-Chief.

### **Submission declaration and verification**

Submission of an article implies that the work described has not been published previously (except in the form of an abstract, a published lecture or academic thesis, see '[Multiple, redundant or concurrent publication](#)' for more information), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. To verify originality, your article may be checked by the originality detection service [Crossref Similarity Check](#).

#### *Preprints*

Please note that [preprints](#) can be shared anywhere at any time, in line with Elsevier's [sharing policy](#). Sharing your preprints e.g. on a preprint server will not count as prior publication (see '[Multiple, redundant or concurrent publication](#)' for more information).

### **Use of inclusive language**

Inclusive language acknowledges diversity, conveys respect to all people, is sensitive to differences, and promotes equal opportunities. Articles should make no assumptions about the beliefs or commitments of any reader, should contain nothing which might imply that one individual is superior to another on the grounds of race, sex, culture or any other characteristic, and should use inclusive language throughout. Authors should ensure that writing is free from bias, for instance by using 'he or she', 'his/her' instead of 'he' or 'his', and by making use of job titles that are free of stereotyping (e.g. 'chairperson' instead of 'chairman' and 'flight attendant' instead of 'stewardess').

All authors should have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted. Generally, the maximum number of expected authors for a clinical or basic science manuscript is 8.

### **Changes to authorship**

Authors are expected to consider carefully the list and order of authors **before** submitting their manuscript and provide the definitive list of authors at the time of the original submission. Any addition, deletion or rearrangement of author names in the authorship list should be made only **before** the manuscript has been accepted and only if approved by the journal Editor. To request such a change, the Editor must receive the following from the **corresponding author**: (a) the reason for the change in author list and (b) written confirmation (e-mail, letter) from all authors that they agree with the addition, removal or rearrangement. In the case of addition or removal of authors, this includes confirmation from the author being added or removed.

Only in exceptional circumstances will the Editor consider the addition, deletion or rearrangement of authors **after** the manuscript has been accepted. While the Editor considers the request, publication of the manuscript will be suspended. If the manuscript has already been published in an online issue, any requests approved by the Editor will result in a corrigendum.

#### *Article transfer service*

This journal is part of our Article Transfer Service. This means that if the Editor feels your article is more suitable in one of our other participating journals, then you may be asked to consider transferring the article to one of those. If you agree, your article will be transferred automatically on your behalf with no need to reformat. Please note that your article will be reviewed again by the new journal. [More information](#).

### **Copyright**

Upon acceptance of an article, authors will be asked to complete a 'Journal Publishing Agreement' (see [more information](#) on this). An e-mail will be sent to the corresponding author confirming receipt of the manuscript together with a 'Journal Publishing Agreement' form or a link to the online version of this agreement.



Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. [Permission](#) of the Publisher is required for resale or distribution outside the institution and for all other derivative works, including compilations and translations. If excerpts from other copyrighted works are included, the author(s) must obtain written permission from the copyright owners and credit the source(s) in the article. Elsevier has [preprinted forms](#) for use by authors in these cases.

For gold open access articles: Upon acceptance of an article, authors will be asked to complete an 'Exclusive License Agreement' ([more information](#)). Permitted third party reuse of gold open access articles is determined by the author's choice of [user license](#).

### **Author rights**

As an author you (or your employer or institution) have certain rights to reuse your work. [More information](#).

#### *Elsevier supports responsible sharing*

Find out how you can [share your research](#) published in Elsevier journals.

### **Role of the funding source**

You are requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement then this should be stated.

#### *Funding body agreements and policies*

Elsevier has established a number of agreements with funding bodies which allow authors to comply with their funder's open access policies. Some funding bodies will reimburse the author for the gold open access publication fee. Details of [existing agreements](#) are available online.

After acceptance, open access papers will be published under a noncommercial license. For authors requiring a commercial CC BY license, you can apply after your manuscript is accepted for publication.

### **Open access**

This journal offers authors a choice in publishing their research:

#### **Subscription**

- Articles are made available to subscribers as well as developing countries and patient groups through our [universal access programs](#).
- No open access publication fee payable by authors.
- The Author is entitled to post the [accepted manuscript](#) in their institution's repository and make this public after an embargo period (known as green Open Access). The [published journal article](#) cannot be shared publicly, for example on ResearchGate or Academia.edu, to ensure the sustainability of peer-reviewed research in journal publications. The embargo period for this journal can be found below.

#### **Gold open access**

- Articles are freely available to both subscribers and the wider public with permitted reuse.
- A gold open access publication fee is payable by authors or on their behalf, e.g. by their research funder or institution.

Regardless of how you choose to publish your article, the journal will apply the same peer review criteria and acceptance standards.

For gold open access articles, permitted third party (re)use is defined by the following [Creative Commons user licenses](#):

#### *Creative Commons Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)*

For non-commercial purposes, lets others distribute and copy the article, and to include in a collective work (such as an anthology), as long as they credit the author(s) and provided they do not alter or modify the article.

The gold open access publication fee for this journal is **USD 3000**, excluding taxes. Learn more about Elsevier's pricing policy: <https://www.elsevier.com/openaccesspricing>.



### *Green open access*

Authors can share their research in a variety of different ways and Elsevier has a number of green open access options available. We recommend authors see our [open access page](#) for further information. Authors can also self-archive their manuscripts immediately and enable public access from their institution's repository after an embargo period. This is the version that has been accepted for publication and which typically includes author-incorporated changes suggested during submission, peer review and in editor-author communications. Embargo period: For subscription articles, an appropriate amount of time is needed for journals to deliver value to subscribing customers before an article becomes freely available to the public. This is the embargo period and it begins from the date the article is formally published online in its final and fully citable form. [Find out more.](#)

This journal has an embargo period of 12 months.

### *Elsevier Researcher Academy*

[Researcher Academy](#) is a free e-learning platform designed to support early and mid-career researchers throughout their research journey. The "Learn" environment at Researcher Academy offers several interactive modules, webinars, downloadable guides and resources to guide you through the process of writing for research and going through peer review. Feel free to use these free resources to improve your submission and navigate the publication process with ease.

### *Language (usage and editing services)*

Please write your text in good English (American or British usage is accepted, but not a mixture of these). Authors who feel their English language manuscript may require editing to eliminate possible grammatical or spelling errors and to conform to correct scientific English may wish to use the [English Language Editing service](#) available from Elsevier's Author Services.

### **Informed consent and patient details**

Studies on patients or volunteers require ethics committee approval and informed consent, which should be documented in the paper. Appropriate consents, permissions and releases must be obtained where an author wishes to include case details or other personal information or images of patients and any other individuals in an Elsevier publication. Written consents must be retained by the author but copies should not be provided to the journal. Only if specifically requested by the journal in exceptional circumstances (for example if a legal issue arises) the author must provide copies of the consents or evidence that such consents have been obtained. For more information, please review the [Elsevier Policy on the Use of Images or Personal Information of Patients or other Individuals](#). Unless you have written permission from the patient (or, where applicable, the next of kin), the personal details of any patient included in any part of the article and in any supplementary materials (including all illustrations and videos) must be removed before submission.

### **Submission**

Our online submission system guides you stepwise through the process of entering your article details and uploading your files. The system converts your article files to a single PDF file used in the peer-review process. Editable files (e.g., Word, LaTeX) are required to typeset your article for final publication. All correspondence, including notification of the Editor's decision and requests for revision, is sent by e-mail.

### *Submit your article*

Please submit your article via <http://ees.elsevier.com/jsurgres/>.

### *Referees*

Please submit the names and institutional e-mail addresses of several potential referees. For more details, visit our [Support site](#). Note that the editor retains the sole right to decide whether or not the suggested reviewers are used.

### **Categorization of Manuscript**

The following categories are used in the Table of Contents:

- Bioengineering/Nanomedicine
- Book Review
- Cardio
- Education
- Gastrointestinal
- Metabolism/Nutrition
- Musculoskeletal

Oncology/Endocrine  
Pediatric/Congenital/Developmental  
Research Review  
Thoracic  
Shock/Sepsis/Trauma/Critical Care  
Transplantation/Immunology  
Vascular  
Wound Healing/Plastic Surgery

## PREPARATION

### *Use of word processing software*

It is important that the file be saved in the native format of the word processor used. The text should be in single-column format. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. In particular, do not use the word processor's options to justify text or to hyphenate words. However, do use bold face, italics, subscripts, superscripts etc. When preparing tables, if you are using a table grid, use only one grid for each individual table and not a grid for each row. If no grid is used, use tabs, not spaces, to align columns. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the [Guide to Publishing with Elsevier](#)). Note that source files of figures, tables and text graphics will be required whether or not you embed your figures in the text. See also the section on Electronic artwork.

To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your word processor.

### **Article structure**

Divide your article into clearly defined sections. Sections should not be numbered. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

### *Essential title page information*

- **Title.** Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
- **Short Title.** Limit of 40 characters (including spaces).
- **Author names and affiliations.** Where the family name may be ambiguous (e.g., a double name), please indicate this clearly. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
- **Corresponding author.** Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. **Ensure that phone numbers (with country and area code) are provided in addition to the e-mail address and the complete postal address. Contact details must be kept up to date by the corresponding author.**
- **Present/permanent address.** If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

**Author contributions.** a paragraph should be included on the title page explaining how each author contributed to the manuscript.

The title of the paper should be no more than 100 characters long.

### **Abstract**

Abstract must emphasize the new and important aspects of the work in no more than 250 words structured into the following sections: background, materials and methods, results, and conclusions.

### **Keywords**

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

### *Introduction*

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

### *Material and methods*

Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference: only relevant modifications should be described. For animal experiments, the sex of animal used must be indicated. If both males and females were used, the number of animals from each sex must be indicated, and it must be indicated whether the sex of animal was considered a factor in the statistical analysis of the data. If only one sex was used for the animal studies, the rationale for using only one sex must be indicated. For cell culture experiments, the sex from which primary cell cultures or tissues were obtained must be indicated. The authors are also encouraged to include sex of cell lines. If cells or tissues from both sexes were used without regard to sex, this should be indicated.

### *Results*

Results should be clear and concise.

### *Discussion*

This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

### *Conclusions*

The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

### *Appendices*

If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

### **Highlights**

Highlights are optional yet highly encouraged for this journal, as they increase the discoverability of your article via search engines. They consist of a short collection of bullet points that capture the novel results of your research as well as new methods that were used during the study (if any). Please have a look at the examples here: [example Highlights](#).

Highlights should be submitted in a separate editable file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point).

### *Acknowledgements*

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

### **Disclosure**

Every author must disclose any financial and personal relationships with other people or organizations that could potentially and inappropriately influence (bias) their work and conclusions. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and research grants or other funding. The existence of competing interests is common and often inevitable. Competing interests are not inherently unethical, but not declaring them is. Any grant funding or support for the article should be listed in this section. If no conflicts exist, the authors should state: The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

### *Formatting of funding sources*

List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

#### *Math formulae*

Please submit math equations as editable text and not as images. Present simple formulae in line with normal text where possible and use the solidus (/) instead of a horizontal line for small fractional terms, e.g., X/Y. In principle, variables are to be presented in italics. Powers of e are often more conveniently denoted by exp. Number consecutively any equations that have to be displayed separately from the text (if referred to explicitly in the text).

#### *Footnotes*

Footnotes should be used sparingly. Number them consecutively throughout the article. Many word processors can build footnotes into the text, and this feature may be used. Otherwise, please indicate the position of footnotes in the text and list the footnotes themselves separately at the end of the article. Do not include footnotes in the Reference list.

### **Artwork**

#### *Electronic artwork*

##### *General points*

- Make sure you use uniform lettering and sizing of your original artwork.
- Embed the used fonts if the application provides that option.
- Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.
- Number the illustrations according to their sequence in the text.
- Use a logical naming convention for your artwork files.
- Provide captions to illustrations separately.
- Size the illustrations close to the desired dimensions of the published version.
- Submit each illustration as a separate file.
- Ensure that color images are accessible to all, including those with impaired color vision.

A detailed [guide on electronic artwork](#) is available.

**You are urged to visit this site; some excerpts from the detailed information are given here.**

#### *Formats*

If your electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply 'as is' in the native document format.

Regardless of the application used other than Microsoft Office, when your electronic artwork is finalized, please 'Save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

EPS (or PDF): Vector drawings, embed all used fonts.

TIFF (or JPEG): Color or grayscale photographs (halftones), keep to a minimum of 300 dpi.

TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings, keep to a minimum of 1000 dpi.

TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.

#### **Please do not:**

- Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors;
- Supply files that are too low in resolution;
- Submit graphics that are disproportionately large for the content.

#### *Color artwork*

Please make sure that artwork files are in an acceptable format (TIFF (or JPEG), EPS (or PDF), or MS Office files) and with the correct resolution. If, together with your accepted article, you submit usable color figures then Elsevier will ensure, at no additional charge, that these figures will appear in color online (e.g., ScienceDirect and other sites) regardless of whether or not these illustrations are reproduced in color in the printed version. **For color reproduction in print, you will receive**

**information regarding the costs from Elsevier after receipt of your accepted article.** Please indicate your preference for color: in print or online only. [Further information on the preparation of electronic artwork.](#)

#### *Illustration services*

[Elsevier's Author Services](#) offers Illustration Services to authors preparing to submit a manuscript but concerned about the quality of the images accompanying their article. Elsevier's expert illustrators can produce scientific, technical and medical-style images, as well as a full range of charts, tables and graphs. Image 'polishing' is also available, where our illustrators take your image(s) and improve them to a professional standard. Please visit the website to find out more.

#### *Figure captions*

Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (**not** on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

#### **Tables**

Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

Please submit Tables in Word format

#### **References**

##### *Citation in text*

Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

##### *Reference links*

Increased discoverability of research and high quality peer review are ensured by online links to the sources cited. In order to allow us to create links to abstracting and indexing services, such as Scopus, CrossRef and PubMed, please ensure that data provided in the references are correct. Please note that incorrect surnames, journal/book titles, publication year and pagination may prevent link creation. When copying references, please be careful as they may already contain errors. Use of the DOI is highly encouraged.

A DOI is guaranteed never to change, so you can use it as a permanent link to any electronic article. An example of a citation using DOI for an article not yet in an issue is: VanDecar J.C., Russo R.M., James D.E., Ambeh W.B., Franke M. (2003). Aseismic continuation of the Lesser Antilles slab beneath northeastern Venezuela. *Journal of Geophysical Research*, <https://doi.org/10.1029/2001JB000884>. Please note the format of such citations should be in the same style as all other references in the paper.

##### *Web references*

As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

##### *Data references*

This journal encourages you to cite underlying or relevant datasets in your manuscript by citing them in your text and including a data reference in your Reference List. Data references should include the following elements: author name(s), dataset title, data repository, version (where available), year, and global persistent identifier. Add [dataset] immediately before the reference so we can properly identify it as a data reference. The [dataset] identifier will not appear in your published article.

##### *References in a special issue*

Please ensure that the words 'this issue' are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.



### *Reference management software*

Most Elsevier journals have their reference template available in many of the most popular reference management software products. These include all products that support [Citation Style Language styles](#), such as [Mendeley](#). Using citation plug-ins from these products, authors only need to select the appropriate journal template when preparing their article, after which citations and bibliographies will be automatically formatted in the journal's style. If no template is yet available for this journal, please follow the format of the sample references and citations as shown in this Guide. If you use reference management software, please ensure that you remove all field codes before submitting the electronic manuscript. [More information on how to remove field codes from different reference management software](#).

Users of Mendeley Desktop can easily install the reference style for this journal by clicking the following link:

<http://open.mendeley.com/use-citation-style/journal-of-surgical-research>

When preparing your manuscript, you will then be able to select this style using the Mendeley plug-ins for Microsoft Word or LibreOffice.

### *Reference formatting*

There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the article number or pagination must be present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct. If you do wish to format the references yourself they should be arranged according to the following examples:

#### *Reference style*

**Text:** Indicate references by (consecutive) superscript arabic numerals in the order in which they appear in the text. The numerals are to be used outside periods and commas, inside colons and semicolons. For further detail and examples you are referred to the *AMA Manual of Style, A Guide for Authors and Editors*, Ninth Edition, ISBN 0-683-40206-4, copies of which may be ordered from Lippincott Williams & Wilkins (<http://www.lww.com/index.html>).

**List:** Number the references in the list in the order in which they appear in the text.

#### Examples:

Reference to a journal publication:

1. Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. *J Sci Commun*. 2010;163:51–59.

Reference to a book:

2. Strunk W Jr, White EB. *The Elements of Style*. 4th ed. New York, NY: Longman; 2000.

Reference to a chapter in an edited book:

3. Mettam GR, Adams LB. How to prepare an electronic version of your article. In: Jones BS, Smith RZ, eds. *Introduction to the Electronic Age*. New York, NY: E- Publishing Inc; 2009:281-304.

Reference to a dataset:

Oguro, M, Imahiro, S, Saito, S, Nakashizuka, T. Mortality data for Japanese oak wilt disease and surrounding forest compositions, Mendeley Data, v1; 2015.

#### *Journal abbreviations source*

Journal names should be abbreviated according to the [List of Title Word Abbreviations](#).

### **Video**

Elsevier accepts video material and animation sequences to support and enhance your scientific research. Authors who have video or animation files that they wish to submit with their article are strongly encouraged to include links to these within the body of the article. This can be done in the same way as a figure or table by referring to the video or animation content and noting in the body text where it should be placed. All submitted files should be properly labeled so that they directly relate to the video file's content. . In order to ensure that your video or animation material is directly usable, please provide the file in one of our recommended file formats with a preferred maximum size of 150 MB per file, 1 GB in total. Video and animation files supplied will be published online in the electronic version of your article in Elsevier Web products, including [ScienceDirect](#). Please supply 'stills' with your files: you can choose any frame from the video or animation or make a separate image. These will be used instead of standard icons and will personalize the link to your video data. For

more detailed instructions please visit our [video instruction pages](#). Note: since video and animation cannot be embedded in the print version of the journal, please provide text for both the electronic and the print version for the portions of the article that refer to this content.

### **Data visualization**

Include interactive data visualizations in your publication and let your readers interact and engage more closely with your research. Follow the instructions [here](#) to find out about available data visualization options and how to include them with your article.

### **Supplementary material**

Supplementary material such as applications, images and sound clips, can be published with your article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as such online). Please submit your material together with the article and supply a concise, descriptive caption for each supplementary file. If you wish to make changes to supplementary material during any stage of the process, please make sure to provide an updated file. Do not annotate any corrections on a previous version. Please switch off the 'Track Changes' option in Microsoft Office files as these will appear in the published version.

### **Research data**

This journal encourages and enables you to share data that supports your research publication where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

Below are a number of ways in which you can associate data with your article or make a statement about the availability of your data when submitting your manuscript. If you are sharing data in one of these ways, you are encouraged to cite the data in your manuscript and reference list. Please refer to the "References" section for more information about data citation. For more information on depositing, sharing and using research data and other relevant research materials, visit the [research data](#) page.

#### *Data linking*

If you have made your research data available in a data repository, you can link your article directly to the dataset. Elsevier collaborates with a number of repositories to link articles on ScienceDirect with relevant repositories, giving readers access to underlying data that gives them a better understanding of the research described.

There are different ways to link your datasets to your article. When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the [database linking page](#).

For [supported data repositories](#) a repository banner will automatically appear next to your published article on ScienceDirect.

In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).

#### *Mendeley Data*

This journal supports Mendeley Data, enabling you to deposit any research data (including raw and processed data, video, code, software, algorithms, protocols, and methods) associated with your manuscript in a free-to-use, open access repository. During the submission process, after uploading your manuscript, you will have the opportunity to upload your relevant datasets directly to *Mendeley Data*. The datasets will be listed and directly accessible to readers next to your published article online.

For more information, visit the [Mendeley Data for journals page](#).

#### *Data statement*

To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process, for example by stating that the research data is confidential. The statement will appear with your published article on ScienceDirect. For more information, visit the [Data Statement page](#).

## **AFTER ACCEPTANCE**

### **Online proof correction**

Corresponding authors will receive an e-mail with a link to our online proofing system, allowing annotation and correction of proofs online. The environment is similar to MS Word: in addition to editing text, you can also comment on figures/tables and answer questions from the Copy Editor. Web-based proofing provides a faster and less error-prone process by allowing you to directly type your corrections, eliminating the potential introduction of errors.

If preferred, you can still choose to annotate and upload your edits on the PDF version. All instructions for proofing will be given in the e-mail we send to authors, including alternative methods to the online version and PDF.

We will do everything possible to get your article published quickly and accurately. Please use this proof only for checking the typesetting, editing, completeness and correctness of the text, tables and figures. Significant changes to the article as accepted for publication will only be considered at this stage with permission from the Editor. It is important to ensure that all corrections are sent back to us in one communication. Please check carefully before replying, as inclusion of any subsequent corrections cannot be guaranteed. Proofreading is solely your responsibility.

### **Offprints**

The corresponding author will, at no cost, receive 25 free paper offprints, or alternatively a customized [Share Link](#) providing 50 days free access to the final published version of the article on [ScienceDirect](#). The Share Link can be used for sharing the article via any communication channel, including email and social media. For an extra charge, paper offprints can be ordered via the offprint order form which is sent once the article is accepted for publication. Both corresponding and co-authors may order offprints at any time via Elsevier's [Author Services](#). Corresponding authors who have published their article gold open access do not receive a Share Link as their final published version of the article is available open access on ScienceDirect and can be shared through the article DOI link.

## **AUTHOR INQUIRIES**

Visit the [Elsevier Support Center](#) to find the answers you need. Here you will find everything from Frequently Asked Questions to ways to get in touch.

You can also [check the status of your submitted article](#) or find out [when your accepted article will be published](#).

© Copyright 2018 Elsevier | <https://www.elsevier.com>