EJCM
ejcvsmed.org
E Journal of Cardiovascular Medicine
Volume 2 Issue 2
July-December 2014
www.ejcvsmed.org

E Journal of Cardiovascular Medicine

New type of pump for the heart-lung bypass system

Nodar Gabriel Khodeli, Otar Sergei Shengelia, Zurab Apollon Chkhaidze, Djumber David Partsakhashvili, Tornike Jemal Sologashvili

Thoracoscopic sympathectomy using single port versus multiple ports as a treatment for palmar hyperhidrosis

Magdi Ibrahim Ahmad Muhammad, Abdulla Allam

Surgical removal of a thrombus formed in the right atrium due to hemodialysis catheter

Alaa Hijazi, Hülya Çiçekcioğlu, Ferit Çiçekçioğlu, Salih Fehmi Katırcıoğlu

HEART AND HEALTH FOUNDATION OF TURKEY
medikal Akademi

E-Journal of Cardiovascular Medicine welcomes scientific contributions in the field of cardiovascular and thoracic surgery - all aspects of surgery of the heart, vessels and the chest in various article types: new ideas, brief communications, work in progress, follow-up studies, original articles, best evidence topics, case reports, reports on unexpected results etc. All manuscripts shall be reviewed by the Editor-in-Chief, Associate Editors, Invited Referees and a Statistician when appropriate. If accepted, articles will be posted online and opened up for discussion. Acceptance criteria are based on the originality, significance, and validity of the material presented.

All material to be considered for publication in E-Journal of Cardiovascular Medicine should be submitted in electronic form via the journal's online submission system. (http://my.ejmanager.com/ejcm/)

A cover letter should be enclosed to all new manuscripts (to be filled in online), specifying the name of the journal and the type of paper, and including the following statements:

• The manuscript should not be previously published in print or electronic form and is not under consideration by another publication.

• All authors should contribute to the content of the article.

• All authors should read and approve the submission of the manuscript to ICVTS.

• Subject to acceptance, authors will sign an exclusive license to publish.

• No ethical problem or conflict of interest should exist.

If your first language is not English, we recommend that you consult an English language editing service to ensure that the academic content of your paper is fully understood by journal editors and reviewers. Language editing does not guarantee that your manuscript will be accepted for publication.

Manuscripts should be prepared using a word-processing package (save in .doc, .docx or .rtf format). The font type and font size should preferably be Arial or Times New Roman 11 points. The manuscript should be double-spaced and should include line and page numbers. The lines of the reference list do not need to be numbered; include a section break before.

Manuscripts should be organized as follows:

(a) Title page; (b) Abstract and Key words; (c) Text with the following sections (not applicable for article types with unstructured abstracts): Introduction, Materials and Methods, Results, Discussion, Acknowledgement (optional), Funding statement, Conflict of interest statement, (d) Figure (and Video) legends; (e) Tables; (f) References.

Title page (1st page): Title: should be brief and descriptive (100 characters) - no abbreviations are allowed, even if well known.

Authors: list all authors by full first name, initial of or full middle name and family name. Qualifications are not required. Ensure the author names correspond (in spelling and order of appearance) with the metadata of the system

Institution(s): include the name of all institutions with the location (department, institution, city, country) to which the work should be attributed (in English). Use superscript numbers to connect authors and their department or institution.

Corresponding author: The full name, full postal address, telephone/fax numbers and the e-mail address should be typed at the bottom of the title page.

Meeting presentation: If the manuscript was (or will be) presented at a meeting, include the meeting name, venue, and the date on which it was (or will be) read; also indicate if you have submitted an Abstract of this manuscript for the EACTS or ESTS annual meeting and whether it has been accepted (if known).

Word count: The total number of words of the whole article (including title page, abstract, main text, legends, tables and references) must be specified on the title page.

Abstract (2nd page): An abstract should be a concise summary of the manuscript. Reference citations are not allowed. The abstract should be factual and free of abbreviations, except for SI units of measurement.

Keywords: Following the abstract, 3-6 keywords should be given for subject indexing.

Introduction: Should state the purpose of the investigation and give a short review of pertinent literature.

Materials and methods: Should be described in detail with appropriate information about patients or experimental animals. Use of abbreviations renders the text difficult to read; abbreviations should be limited to SI units of measurement and to those most commonly used, e.g. VSD, ASD, CABG (abbreviations should not be included in headings and extensions should be included at first mention).

Results: Results should be reported concisely and regarded as an important part of the manuscript. They should be presented either in tables and figures, and briefly commented on in the text, or in the text alone. Repetition of results should be avoided!

Discussion: The discussion is an interpretation of the results and their significance with reference to pertinent work by other authors. It should be clear and concise.

Acknowledgement: Acknowledgements and details of non-financial support must be included at the end of the text before the references. Personal acknowledgements should precede those of institutions or agencies.

Tables: All tables must be included in the manuscript file, should start on separate pages and be accompanied by a title, and footnotes where necessary. The tables should be numbered consecutively using Arabic numerals. Units in which results are expressed should be given in parentheses at the top of each column and not repeated in each line of the table.

References: Authors are responsible for checking the accuracy of all references. If you use EndNote or Reference Manager to facilitate referencing citations (not required for submission), this journal's style is available for use. References should be numbered in order of appearance in the text (in Arabic numerals in parentheses) and must be listed numerically in the reference list. Journal titles and author initials should be properly abbreviated and punctuated.

Volume 2 | Number 2 | July-December 2014

Research Articles

Case Report

Received: 15/12/2013 **Accepted:** 11/03/2014 **Published:** 15/09/2014

EJCM 2014; 02 (2): 23-28 **Doi: 10.15511/ejcm.14.00123**

Thoracoscopic sympathectomy using single port versus multiple ports as a treatment for palmar hyperhidrosis

Magdi Ibrahim Ahmad Muhammad[1], Abdulla Allam[2]

[1)] Department Of Cardio-thoracic Surgery, Faculty Of Medicine, Suez Canal University, Egypt
[2)] Department Of Thoracic Surgery, King Fahd Hospital, Al-madina Al-munawara, Saudi Arabia

Summary

Objective: Hyperhidrosis can cause significant professional and social handicaps. Thoracic endoscopic sympathectomy has become the surgical technique of choice for treating intractable palmar hyperhidrosis. Endoscopic thoracic sympathectomy can be carried out through multiple ports or by using a single port. A prospective study was undertaken to compare outcomes between two methods.

Material and Method: Between January 2008 and June 2012, 71 consecutive patients [30 male and 41 female; aged 22 ± 5.3 years] underwent video-assisted sympathectomy for palmar hyperhidrosis are included in this study. In all cases, the procedure was bilateral. The procedure was performed in one stage in all patients. All patients were seen 1 month and follow-up to one year after the operation. Patients were subdivided into 2 groups: Group A-35 patients underwent multiple ports video-assisted sympathectomy and Group B-36 patients underwent single port video-assisted sympathectomy. Preoperative, intraoperative and postoperative variables, morbidity, recurrence, and survival are compared in both groups.

Results: Successful sympathectomies were performed in 100 % of the patients; the follow-up was from 1 to 12 months (mean 6 ± 3.4 months). There was no recurrence of palmar hyperhidrosis. No Horner's syndrome was reported. No mortality or serious post-operative complications. There was no conversion to an open procedure. Residual minimal pneumothorax occurred in two patients (5.7%) in group A and in one patient (2.8%) in group B. Minimal hemothorax occurred in one patient (2.9%) in group A and in three patients (8.3%) in group B. Compensatory hyperhidrosis encountered in seven patients (20%) in group A and in eight patients (22.2%) in group B.

Conclusion: No difference between bilateral multiple ports and single port video-assisted thoracoscopic sympathectomies and both are effective, safe and minimally invasive procedures improving permanently the quality of life in patients with palmar hyperhidrosis.

Keywords: Palmar hyperhidrosis, sympathectomy, single port.

Please cite this article as: ***Muhammad MIA, Allam A. Thoracoscopic sympathectomy using single port versus multiple ports as a treatment for palmar hyperhidrosis. EJCM 2014; 02 (2): 23-28. Doi: 10.15511/ejcm.14.00123.***

Introduction

Primary hyperhidrosis is an idiopathic condition characterized by excessive sweating particularly in response to temperature or emotional stimuli occurring in up to 1% of the population, with an apparent increased prevalence in countries of the Far East.[1] The areas of the body commonly affected in hyperhidrosis in order of frequency include the palms, feet, axilla, head, or face. These symptoms usually begin in childhood or adolescence, often representing an incapacitating and embarrassing disorder that can interfere with social and professional activities.[2]

Early surgical management for hyperhidrosis required an open thoracotomy. This was accompanied by a prolonged recovery period and significant morbidity including Horner's syndrome.[3,4] However, with recent advances in video-assisted thoracoscopy, upper thoracic dorsal sympathectomy has been shown as a safe and minimally invasive procedure for palmar and axillary hyperhidrosis.[5] In addition, it can be performed using single or multiple ports.[6,7] The incidence and severity of complications following treatment with video-assisted thoracoscopy has been shown to decline, with reported incidences of Horner's syndrome ranging from 0 to 1.9%.[8-11]

This prospective study aims to show operative and postoperative results after simultaneous bilateral video-assisted thoracic sympathectomy using single versus multiple ports.

Materials and methods

Patient selection

From January 2008 through June 2012, 71 patients (30 male and 41 female; aged 22 ± 5.3 years) were included in this prospective study at our department of cardiothoracic surgery, King Fahd hospital. All patients had experienced disabling hyperhidrosis of their palms since adolescence and had undergone medical therapy with topical agents without much improvement. The patients reported that the symptoms had significantly affected their work or social conditions. All patients underwent a careful clinical history; basic preoperative investigations were performed including chest x-ray. CT thorax is not routinely requested unless suggested by history, or an abnormal chest x-ray. Patients with secondary hyperhidrosis were excluded from this study. Patients were consecutively randomized into two groups: Group A-35 patients underwent multiple ports video-assisted sympathectomy and Group B-36 patients underwent single port video-assisted sympathectomy.

Informed consent was obtained before surgery and a study approval from the Ethics Committee was provided. Our protocol included a follow-up at one month postoperative and for one year. Follow-up data were obtained in all patients by telephone interview. Clinical examination was added only when the patient reported objective physical signs, such as Horner's syndrome.

Operative technique

Surgery was performed under general anesthesia and one-lung ventilation using a double-lumen endotracheal tube. Patients were placed in semi-Fowler's position with arms gently abducted. A small roll was placed transversely behind the scapulae to slightly elevate the axilla from the operating table. A fingertip pulse oximeter probe was used to record the changing pattern of the plethysmographic curve on the operated side. The surgeon stood at the side, facing the patient, and the video screen was positioned above the patient's head.

In multiple ports group, after exclusion of the lung, a 5-mm, 0 degree telescope (Karl Storz, Germany) and two additional 3-mm ports for micro instruments. The sympathetic chain is easily identified under the parietal pleura, running vertically over the necks of the ribs in the upper costo-vertebral region. The mediastinal pleura was opened and the sympathetic chain was dissected, severed, and removed from the second thoracic ganglion (T2) to the third (T3). Dissection was carried out with high-frequency cautery except at the level of T2, where no coagulation was used to prevent current diffusion to the stellate ganglion.

Generally we continue the dissection by cauterizing/dividing the pleura for 5 cm lateral to the chain including an aberrant nerve bundle of Kuntz if identified. The transected ends of the sympathetic chain are separated as far as possible and cauterized to prevent regrowth of the nerve and recurrence of symptoms. Care should

be taken not to divide the sympathetic chain above the level of the second rib for the treatment of palmar hyperhidrosis, because it increases the risk of Horner's syndrome and contributes little benefit.

In single port group, after exclusion of the lung, a single, 1-cm-long incision was made for insertion of a 12-mm trocar (Endopath, Ethicon Endo-Surgery, Inc., Cincinnati, OH, USA) into the pleural cavity at the third intercostal space in the midaxillary line. A straightforward, 0° operating thoracoscope (Karl Storz, Tuttlingen, Germany) was introduced. The dorsal sympathetic chain was identified running along the neck of the ribs close to the costovertebral junctions.

The first rib was always identified by direct vision or, in patients with adiposity, by palpation under visual control. The stellate ganglion (T1) was avoided. A diathermy hook (Jarit 600-305, Tuttlingen, Germany) inserted through the thoracoscope was used to completely divide the sympathetic trunk over the neck of the second and third ribs (T2–T3) including the rami communicanti and the accessory fibers of Kuntz, if present. At this level, the chain was divided with diathermy cautery after gentle anterior traction on the nerve; hook recoil after division was avoided to prevent vascular or lung injury. In order to destroy all the accessory sympathetic fibers, we dissected the pleura along the second rib up to approximately 5 cm lateral to the sympathetic chain.

In both groups, the entire procedure was then repeated on the opposite side, without changing the position of the patient or the operative setting. Complete ablation of the ganglia was validated by the presence of peripheral vasodilatation, warm and dry hands, and an instant change in amplitude of the waveform patterns of the pulse oximeter, indicating an increase in circulation after sympathectomy. At the end of the procedure, a temporary 10-Ch chest tube was inserted into the thoracic cavity through the surgical incision and connected to a water-seal system applying a mild suction. After reinflating the lungs, the chest tube was quickly removed and the incision was closed. A chest X-ray was performed during the first postoperative day before the discharge to ascertain complete lung expansion.

All patients received postoperative analgesics and all patients were seen one month after the operation and follow up for one year. Follow-up data were obtained in all patients by telephone interview. Clinical examination was added only when the patient reported objective physical signs, such as Horner's syndrome.

Data analysis

Preoperative data were collected regarding the patients' demographic details. Also, we evaluated the effect of two operative techniques on the following clinical outcomes:

1. operative time which was defined as the interval between first port incision and completion of wound closure;
2. intra-operative complications;
3. postoperative complications include pneumothorax, hemothorax, Horner's syndrome, recurrence and compensatory sweating;
4. postoperative length of hospital stay which was defined as the interval between date of intervention and date of hospital discharge; and
5. perioperative mortality rate which was defined as the percentage of patients who died of causes related or unrelated to disease or procedure within 30 days of surgery.

Statistical Methods

The data associated with the multiple ports and single port video-assisted sympathectomies were calculated and expressed as percentage and mean ± SD in different situation by using paired t test. Differences were significant at P Value< 0.05. All analysis was performed with the SPSS 13.0 for Windows (SPSS Inc, Chicago, IL).

Results

During the period between January 2008 and June 2012, 71 patients with palmar hyperhidrosis underwent video-assisted thoracoscopic sympathectomy. The demographics, operative and postoperative outcomes of the two groups are outlined in (Table 1) The two groups were similar in terms of age and sex distribution.

Operative time was not statistically significant (p value was 0.19); where mean operative time in Group [A] was 39.03 ± 5.1 min. while in Group [B] it was 37.07 ± 7.1 min. respectively. There were no intra-operative complications, and no patient required conversion

to an open procedure.

Postoperative length of hospital stay was not statistically significant (p value was 0.15); where mean postoperative length of hospital stay in group[A] was 1.1±0.4 days while in group [B] the mean postoperative length of hospital stay were 1.2±0.3 days.

In both groups, the success rate was 100%, there were no cases of Horner's syndrome (ptosis) and there was no perioperative mortality. Residual minimal pneumothorax occurred in two patients (5.7%) in group A and in one patient (2.8%) in group B. Minimal hemothorax occurred in one patient (2.9%) in group A and in three patients (8.3%) in group B. In our patients, all pneumothoraces were small, limited, and resolved without chest tube placement. Also, hemothorax was small and none needed drainage.

Compensatory hyperhidrosis was affecting trunk and/or abdomen encountered in seven patients (20%) in group A and in eight patients (22.2%) in group B. The difference in the rate of compensatory hyperhidrosis in the two groups was not statistically significant and the symptoms were not severe enough to interfere with lifestyle, and this required no further treatment. Parenteral analgesia was not required and postoperative pain was managed effectively in both groups with oral analgesics alone. Follow-up of all patients for one year revealed no recurrence of symptoms and all patients maintained dry hands.

Discussion

Thoracotomy was the standard surgical approach for hyperhidrosis[12] but the introduction of video-assisted thoracoscopic surgery (VATS) and the advances in video-endoscopic technology had replaced open surgery for performing sympathectomy, determining a shorter hospital stay, reduced morbidity rates, less pain and better cosmetic results for a non-life risk disease.[13]

Video-assisted thoracoscopic sympathectomy usually done through multiple ports but more recently, the integration of electrocautery/diathermy to the thoracoscope permits a single-port procedure and this approach

Table 1. Profile of adult patients undergoing multiple ports and single port video-assisted sympathectomy

	Group [A] Multiple ports video-assisted sympathectomy	Group [B] Single port video-assisted sympathectomy	p Value
Number	**35**	**36**	
Age (years)	**21 ± 3.1**	**23 ± 1.3**	**0.22**
Sex (M/F)	**17/22**	**13/19**	
Operative time [min.]	**39.03±5.1**	**37.07±7.1**	**0.19**
Intraop. complications	**0**	**0**	
Postop. complications:			
Pneumothorax	**2**	**1**	
Hemothorax	**1**	**3**	
Horner's syndrome	**0**	**0**	
Recurrence	**0**	**0**	
Compensatory sweating	**7**	**8**	
Perioperative mortality	**0**	**0**	
Hospital lengths of stay [d.]	**1.1±0.4**	**1.2±0.3**	**0.15**

Intraop: *Intraoperative,* **Postop:** *Postoperative*

has been shown to be faster, provides excellent cosmetic and functional outcomes.[14-16]

The development of residual pneumothorax is a well-known complication of endoscopic thoracic operations and is not specific to this procedure.[7] In our patients, residual minimal pneumothorax occurred in two patients (5.7%) in group A and in one patient (2.8%) in group B, a rate comparable to that in other reports.[14,17]

In this study, there were no reported episodes of postoperative Horner's syndrome. Interestingly, in the early reports of endoscopic thoracic surgery, the incidence of Horner's syndrome was as high as 12% but improved familiarity with the procedure and the anatomy; in particular the avoidance of the superior third of the stellate ganglion has resulted in rates of less than 1% in more modern series.[18,19]

Compensatory hyperhidrosis was affecting trunk and/or abdomen encountered in seven patients (20%) in group A and in eight patients (22.2%) in group B. Other series have reported compensatory hyperhidrosis between 67% and 85%.[20-23] The incidence and degree of compensatory hyperhidrosis appear to depend on the extent of resection of the sympathetic chain, which may account for the differences in various series.

Our technique involves limited excision of the ganglia at T2- T3 for palmar hyperhidrosis to minimize compensatory symptoms. The symptoms were not severe enough to interfere with lifestyle, and this required no further treatment. No recurrence was observed in our patients. These results are in line with those reported by other authors.[18,24] No mortality was reported in our experience. Previous studies showed that the overall intraoperative morbidity (i.e. chylothorax, lung or vessels damage) is nearly 0.2%,[24] reporting complications during surgery and conversion to thoracotomy.[9,25] However none of these issues was observed in our study.

Conclusion

No significant difference between bilateral multiple ports and single port video-assisted thoracoscopic sympathectomies and both are effective, safe and minimally invasive procedures improving permanently the quality of life in patients with palmar hyperhidrosis. Careful patient selection and preoperative counseling are important to ensure a satisfactory outcome.

References

1. Lin C. Extended thoracoscopic T2 sympathectomy in treatment of hyperhidrosis. Experience with 130 consecutive cases. *J Laproendoscopic Surg* 1992;2:1.
2. Ibrahim M, Menna C, Andreettia C, Ciccone AM, D'Andrilli A, Maurizi G, Poggi C, Vanni C, Venuta F, Rendina EA. Two-stage unilateral versus one-stage bilateral single-port sympathectomy for palmar and axillary hyperhidrosis. *Interact CardioVasc Thorac Surg* (2013) 16 (6): 834-838.
3. Adur R., Kurchin A., Zweis A., Mozes M. Palmar hyperhidrosis and its surgical treatment: A report of 100 cases. *Ann Surg* 1977;186:34-71.
4. Hashmonai M., Kopelnam D., Klein O., Schein M. Upper thoracic sympathectomy for primary palmar hyperhidrosis: Long-term follow-up. *Br J Surg* 1992;79:268-271.
5. Ambrogi V,Campione E, Mineo D, Paternò EJ, Pompeo E, Mineo TC. Bilateral thoracoscopic T2 to T3 sympathectomy versus botulinum injection in palmar hyperhidrosis. *Ann Thorac Surg* 2009;88:238-45.
6. Chen YB, Ye W, Yang WT, Shi L, Guo XF, Xu ZH, et a . Uniportal versus biportal video-assisted thoracoscopic sympathectomy for palmar hyperhidrosis. *Chin Med J* 2009;122:1525-8.
7. Georghiou GP, Berman M, Vidne BA, Saute M. Minimally invasive thoracoscopic sympathectomy for palmar hyperhidrosis via a transaxillary single-port approach. *Interact CardioVasc Thorac Surg* 2004;3:437-441.
8. Doo Y., Yong H. Needle thoracic sympathectomy for essential hyperhidrosis: Intermediate-term follow-up. *Ann Thorac Surg* 2000;69:251-253.
9. Gossot D., Kabiri H., Caliandro R., Debrosse D., Girard P., Grunenwald D. Early complications of thoracic endoscopic sympathectomy: a prospective study of 940 procedures. *Ann Thorac Surg* 2001;71:1116-1119.
10. Gossot D., Galetta D., Pascal A., et al. Long-term results of endoscopic thoracic sympathectomy for upper limb hyperhidrosis. *Ann Thorac Surg* 2003;75:1075-1079.
11. Yim A.P.C., Liu H.P., Lee T.W., Wan S., Arifi A.A. Needlescopic video-assisted thoracic surgery for palmar hyperhidrosis. *Eur J Cardiothorac Surg* 2000;17:697-701.
12. Kopelman D, Hashmonai M. Upper thoracic sympathetic surgery. Open surgical techniques. *Clin Auton Res* 2003;13 (Suppl 1):I10-5.
13. Nüesch B, Ammann J, Hess P, Lüdin A. Thoracic sympathectomy in palmar hyperhidrosis: comparison of open with thorascopic procedure. *Swiss Surg* 1996; 3:112-5.
14. Lardinois D, Ris HB .Minimally invasive video-endoscopic sympathectomy by use of a transaxillary single port approach. *Eur J Cardiothorac Surg* 2002;21:67-70.
15. Weight C.S., Raitt D., Barrie W.W. Thoracoscopic sympathectomy: a one-port technique. *Aust N Z J Surg* 2000;70(11):800.
16. Vallieres E. Endoscopic upper thoracic sympathectomy. *Neurosurg Clin N Am* 2001;12(2):321-327.
17. Herbst F, Plas EG, Fugger R, Fritsch A. Endoscopic thoracic sympathectomy for primary hyperhidrosis of the upper limbs. A critical analysis and long-term results of 480 operations. *Ann Surg* 1994;220:86-90.
18. Doolabh N., Horswell S., Williams M., Huber L., Prince S., Meyer D.M., Mack M.J.Thoracoscopic sympathectomy for hyperhidrosis: indications and results. *Ann Thorac Surg* 2004;77(2):410-414.
19. Murphy MO, Ghosh J, Khwaja N, Murray D, Halka AT, Carter A, Turner NJ, Walker MG. Upper dorsal endoscopic thoracic sympathectomy: a comparison of one- and two-port ablation techniques. *Eur J Cardiothorac Surg* (2006) 30(2): 223-227.
20. Fox A.D., Hands L., Collin J. The results of thoracoscopic sympathetic trunk transection for palmar hyperhidrosis and sympathetic ganglionectomy for axillary hyperhidrosis. *Eur J Endovasc Surg* 1999;17:343-346.
21. Hsia J.Y., Chen C.Y., Hsu C.P., Shai S.E., Yang S.S. Outpatient thoracoscopic limited sympathectomy for hyperhidrosis palmaris. *Ann Thorac Surg* 1999;67:258-259.
22. Lin C.-L., Yen L.-P., Howag S.-L. The long term result of upper dorsal sympathectomy for palmar hyperhidrosis. *Jpn J Surg* 1999;29:209-213.
23. Reisfeld R., Nguyen R., Pnini A. Endoscopic thoracic sympathectomy for hyperhidrosis, experience with both cauterization and clamping methods. *Surgical Laparoscopy* 2002; 12: 255-267.
24. Moya J, Ramos R, Morera R, Villalonga R, Perna V, Macia I, et al. Results of high bilateral endoscopic thoracic sympathectomy and sympatholysis in the treatment of primary hyperhidrosis: a study of 1016 procedures. *Arch Bronconeumol* 2006;42:230- 234.
25. Alric P, Branchereau P, Berthet JP, Léger P, Mary H, Mary-Ané C. Video-assisted thoracoscopic sympathectomy for palmar hyperhidrosis: results in 102 cases. *Ann Vasc Surg* 2002;16:708-13.

Received: 15/12/2013
Accepted: 11/03/2014
Published: 15/09/2014

Disclosure and conflicts of interest:
Conflicts of interest were not reported.

Corresponding author:
Dr. Magdi Ibrahim Ahmad Muhammad
Mail: magdi.wahdan@gmail.com

Received: 23/11/2012 **Accepted:** 17/12/2013 **Published:** 15/09/2014

EJCM 2014; 02 (2): 29-32 **Doi: 10.15511/ejcm.14.00129**

New type of pump for the heart-lung bypass system

Nodar Gabriel Khodeli[1], Otar Sergei Shengelia[2], Zurab Apollon Chkhaidze[1], Djumber David Partsakhashvili[3], Tornike Jemal Sologashvili[4]

[1)] Tbilisi State University, Medical Faculty, Clinic Of Heart Surgery, Tbilisi, Georgia
[2)] Department Of Technological Researches Of Philips Corporation, Tbilisi, Georgia
[3)] Tbilisi State University, Medical Faculty, Scientific-training Center Of Experimental Surgery, Tbilisi, Georgia
[4)] State Hospital, Open Heart Clinic, Tbilisi, Georgia

Summary

Objective: Complications arising from roller pump usage in modern heart-lung bypass (HLB) systems are widely known. Alternative to roller pumps has existed as various devices. This work is dedicated to developing new, considerably simpler and less expensive pump device for HLB systems, which provides maximally physiological pulsating blood flow.

Material and Method: We used pediatric cardiotomy reservoirs of HLB systems as blood chambers. Two such reservoirs were placed in front of the oxygenator, with their in-flow tubes connected to the venous blood tubes, and the outflow tubes – to the entry to the oxygenator. In each reservoir, 2 air outlets tubes were connected to pneumo-receivers of positive and negative pressure. We filled up one of the reservoirs whith closed of exit blood tube by creating negative pressure in it. Simultaneously, with closed entry blood tube of the second reservoir, we ejected blood from it by created positive pressure. Used external pulsator.

Results: In stand testing under re-circulation regime, productivity of the device was 12,5 liters/minute. Pressure on exit blood pump was within 0 to 300mm.Hg. The pump operating system enabled laminar, as well as pulsating flow of liquid, with frequency of 0-200 pulses/minute. Research is based on experiments conducted on 14 mongrel dogs weighing 20 kg. Standard methodology was used to cannulate Venae cavae and aorta, and to connect perfusion system to body. Duration of complete HLB reached 2 hours. Systolic pressure was maintained within 120-130mm.Hg.; diastolic - 70-80 mmHg. Velocity of blood flow in the aorta arc fluctuated within 950-1100 ml/min; in the femoral artery – within 60-80 ml/min.

Conclusion: Preliminary tests of the new pump indicate that its hemodynamic characteristics are maximally approximated to physiological ones. In comparison to modern machines, a perfusion system with new pump type has minimal volume of fill-up and does not damage formative elements of blood.

Keywords: Pulsatille flow, blood pump, perfusion.

Please cite this article as: ***Khodeli N., Shengelia O., Chkhaidze Z., Partsakhashvili D., Sologashvili T. New type of pump for the heart-lung bypass system.EJCM 2014; 02 (2): 29-32. DOI: 10.15511/ejcm.14.00129.***

Introduction

Majority of currently operating systems of artificial blood circulation for heart-lung bypass applies roller pumps as injecting units.[4,7] Though currently these units and their control systems are very well developed, number of authors report on complications in the process of their functioning. Complications, related to the constructional characteristics of the roller pumps declare themselves in a form of homeostasis disorder of various degrees, buffer deviations, centralization of blood circulation, accumulation of sub-oxide products, impairment of entirety of membranes of the blood cells etc. [1,3,10,13] Non-physiological blood flow, caused by the roller pump in the aorta and large vessels is regarded as the major reason for such complications.

Numerous attempts of some authors to replace the roller pumps with other pressurizing devices[2,11] remained within the experimental laboratories. At the same time, there exists the reliable alternative to the roller pumps – the artificial heart ventricles, which form in the arterial bed the flood flow maximally close to the physiological, excluding traumas of the blood cells.[6,12] Ventricular Assist Device are widely applied in clinics as the systems of assisted blood circulation, though they are not used in the HLB machines. Supposedly, this is caused by their high prices.

Development of new, simple and cheap perfusion device for HLB machines and study of their hydrodynamic characteristics in the experiments with animals.

Materials and methods

As a basis model of the pump we used the device developed in our laboratory.[9] In the pump module of the developed device the blood accumulation and its forcing function was unified in two hermetic transparent reservoirs with rigid walls, with the volume selected for given experimental animal. For simplification of assembling of the experimental pump devices (**see Fig. 1**) used for relatively large test animals we employed cardiotomic reservoirs of used traditional children's disposable HLB systems, with volume of 1000 ml each.

In the assembly scheme of each perfusion machine two such reservoirs were located before membrane oxigenator on the level of surgical table. Two inlet jets for blood (inner diameter up to 6 mm) of each of the reservoirs were connected with each other and supply venous trunk (inner diameter up to 10 mm). Outlet jets are connected with each other and the trunk leading to the oxigenator (inner diameter up to 6 mm). In each of the reservoirs the jets of the air outlets are connected with the pneumatic receivers of positive and negative pressures with special external valves controlled electronically, included into the pump unit, provided filling of one of the reservoirs, creating negative pressure in it, if the outlet trunk is closed and simultaneously, from the other reservoir there was provided pressurizing, supplying positive pressure with the closed inlet trunk.

In the trunk connecting the outlet of oxigenator with the inlet of arterial filter there was placed the external pulsating unit also included into the pump unit. Electronically controlled pulsating unit, pressing the trunk to certain level, allowed changing of the frequency of contractions, steepness of growth and fall of pressure (dp/dt) and duration of systole and diastole. In the control system there is also included the unit for control of the level of liquid in the reservoirs and switch of valves, regulating sequence of functions of letdown and pressurizing. For use of the perfusion system on small laboratory animals only the volume of the pump reservoirs and diameters of connecting trunks were changed. Thus, the total volume of system filling was changed.

Monitoring of the pneumatic pressure in the chambers of the reservoirs and pressure of pulsation frequency, volume of blood flow in the connecting trunks and vessels of the biological model was pro-vided by means of the electromagnetic sensors of polygraph "Mingograf-81" - Elema Shonander (Sweden) and flow meter "Nihon Kohden" (Japan). In the experiments with the animals there was also measured the temperature in the rectum and oesophagus and cardiogram was made. Acid-base condition of the blood was measured by means of gas analyzer "Astrup" – Denmark.

Results

Stand tests were conducted with the purpose of determining of hydrodynamic capacities of the pump device and reliability of its control system. They allowed for identification of basic characteristics of the pump device and the machine as a whole. The system, assembled entirely on the vertical holder allows for maximal approach to the object of perfusion, thus significantly

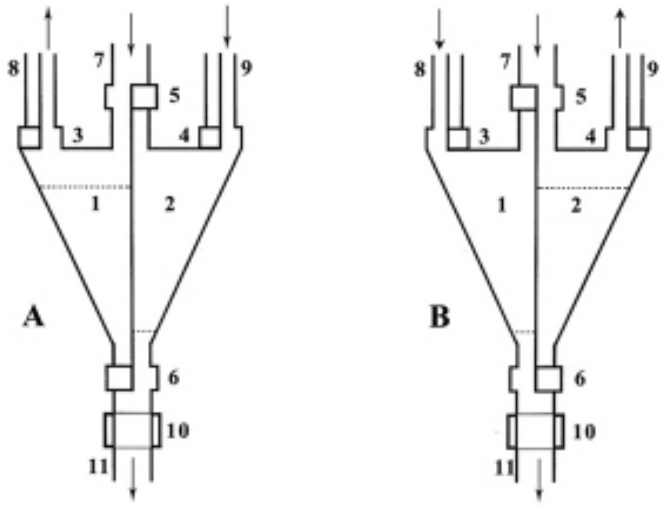
reducing the volume of filling.[8] In the closed regime of circulation, with 6-mm connecting trunks capacity of the machine was 8.5 l/min. Pressure on the outlet trunk was regulated within 0-300 mmHg and within the system it mainly was dependent on resistance of oxigenator and arterial filter. In the regime "Stop" levels of the liquids in the pump reservoirs was maintained unchanged and this did not require pressing of the trunks. Pump control system allowed for creation of both, laminar and pulsating flow of the liquid on the outflow trunk.

The perfusion system was tested in the acute experiments (14 experiments) on the mongrel dogs of both sexes, with up to 20 kg weights, on which, in the conditions of intravenous narcosis and sternotomy, by means of standard techniques, there was conducted cannulation of the vena cavas and aorta. The perfusion system was filled with the blood substitute (total volume of filling was 900-1000 ml of Ringer's solution with 5000 units of heparin), in the recirculation process there were removed the bubbles of air and the system was stopped. Arterial trunk was connected from the filter to the aortal cannula and the inflow, venous trunk - to the triple connection of the venous cannulas. The parallel heart-lung bypass in the direction of blood flow was commenced in one of the pump reservoirs.

After its filling to the conditional mark (corresponding to 700 ml), flow of venous blood was directed to another reservoir and to the first one, air was supplied from the receivers under the pressure (150-200 mmHg). Thus, the blood pressing through the arterial filter into aorta was commenced. Capacity of the system was no more than 1200 ml/min. Redistribution of blood in the reservoirs, as well as providing pressure and relieve in turns in the chambers was provided automatically from the control system. We conducted simultaneous normothermal perfusion with the operating heart and natural oxygenation for the period up to 1 hour.

Further we provided full HLB, carrying out cardioplegia, clamping aorta and terminating artificial ventilation of lungs. Duration of full heart-lung bypass achieved 3 hours. Systolic pressure was maintained within 120-130 mmHg; diastolic – 70 – 80 mmHg (average pressure in the femoral artery for entire period of perfusion was no less than 75 mmHg). Volume velocity of blood flow in the arch of aorta was within 950 – 1100 ml/min and in the femoral artery – 60 – 80 ml/min.

Regarding requirements of the experimenters in this sphere[5] there was developed miniature version of the perfusion system, tested in the first experiments on 17 rats, to which it was connected by the scheme: left middle – descending aorta, with retrograde pressurizing of blood (without occlusion of ascending aorta, in the conditions of cold cardioplegia (fibrillation of the ventricles). As a result of full heart-lung bypass in 13 cases there was observed spontaneous restoration of heart operation after 30-minute perfusion. In no one of the conducted experiments hemolysis was not observed in



A – Phase one (Filling of chamber 1 and emptying of chamber 2). Filling and emptying of pump chambers is regulated by a control block so, that as the first chamber of the pump fills with liquid, the second is emptied. In the beginning position, the second chamber is filled with liquid up to the uppermost punctuated line. The occlusive device 3 cutts off the air pressure tube 8 and opens the vacuum tube 8 in chamber 1. Simultaniously, the occlusive device 4 cuts off the vacuum tube 9 and opens the air pressure tube 9 in chamber 2. In this manner, liquid through tube 7 gets into chamber 1 and fills up gradually up to the punctuated line. The occlusive device 6 of the outlet tube of chamber 1 is closed, while the occlusive device of outlet tube of chamber 2 opens. In this way, liquid from chamber 2, under pressure injected through pulsator into the outlet tube for liquids.
In the second phase (B) the chamber 1 empties while the chamber 2 is filled. Switching of the occlusive devices is controlled by liquid level sensores in chambers.

Figure 1. Principal Scheme and Phases of Pump Operation. *1. First chamber of pump; 2. Second chamber of pump; 3. Air and fluid switching valves; 4. Pulsator; 5. Blood outflow tube from the pmp; 6. Blood inflow tube in the pump; 7. Tubes for creating air ressure and vacuum; 8. Electrical connections to the control system.*

Please cite this article as: ***Khodeli N., Shengelia O., Chkhaidze Z., Partsakhashvili D., Sologashvili T. New type of pump for the heart-lung bypass system.EJCM 2014; 02 (2): 29-32. DOI: 10.15511/ejcm.14.00129.***

the blood tests.

Conclusion

First attempts of operation in the experiments on non-traditional systems of heart-lung bypass and pulsatile perfusion showed possibility of achievement if hemodynamic characteristics identical to physiological ones. In comparison with the traditional machines the system has minimal volume of filling and does not damage blood cells. Constructive pumping system and entire perfusion system are quite simple and the control system allows achievement of hemodynamic characteristics maximally close to physiological ones. In addition, the system could be applied on the experiments on both, large and small experimental animals.

References

1. Ashraf S., Bhattacharya K., Zacharias S. et all. Serum S100 release coronary after bypass grafting: roller versus centrifugal pump Ann. Thorac. Surg.-1998.-Vol.66.-N5.-P.1958.
2. Asimakopoulos G., Smith P.L., Ratnatunga C.P., Taylor K.M. Lung injury and acute respiratory distress syndrome after cardiopulmonary bypass Ann. Thorac. Surg.-1999.-Vol. 68.-N3.-P.1107-15.
3. Ballaux P.K., Gourlay T., Ratnatunga C.P., Taylor K.M. A literature review of cardiopulmonary bypass models for rats. Perfusion 1999.-Vol.14.- N6, p. 411-7.
4. Chilaia S.M., Khodeli N.G. Biventricular Bypass: Alternative to Univentricular Bypass and Total Artificial Heart-Bridge. Artificial Organs.-1991.-Vol.15.-№5.-P.357-62.
5. Gundry S.R., Romano M.A., Howard Shattuck O. Seven-year follow-up coronary artery bypasses performed with and without cardiopulmonary bypass. J.Thorac. Cardiovasc. Surg. 1998.- Vol.115.- N6, p.1273.
6. Khodeli N., Chanturia R., Landau I., Mumladze M. The pulsatile flow device for the heart-lung bypass. Statepatent P 2467. Georgia.1999.
7. Khodeli N., Partsakhashvili D. The pulsatile flow device for the heart-lung bypass. Statepatent P 3975. Georgia. 2004.
8. McCusker K., Lee S. Post cardiopulmonary bypass bleeding: an intraductory review. J. Extra Corpor Technol.- 1999.-Vol.31.-N1.-P.23-36.
9. Mulay A.V., Zacharias S., Hansbro S.D. Should intraaortic ballon countrpulsation be continued during cardiopulmonary bypass? J. Thorac. Cardiovasc. Surg.-1997.-Vol.114.-N6.-P.1128.
10. Rakhorst G., Hensens A.G., Verkerke G.J. In -vivo evaluation of the "HIA-VAD": a new German ventricular assist device. J.Thorac.Cardiovasc.Surg.1994.- Vol.42.-N3, p.136-40.
11. Sistino J.J., Acsell J.R. Systemic inflammatory response syndrome (SIRS) following emergency cardiopulmonary bypass: a case report and literature review. J. Extra Corpor Technol 1999.- Vol.31.- N1, p.37-43.

Received: 23/11/2012
Accepted: 17/12/2013
Published: 15/09/2014

Disclosure and conflicts of interest:
Conflicts of interest were not reported.

Corresponding author:
Dr. Nodar Gabriel Khodeli
zurab.chkhaidze@tsu.ge

Received: 21/11/2013 **Accepted:** 18/07/2014 **Published:** 15/09/2014

EJCM 2014; 02 (2): 33-35 **Doi: 10.15511/ejcm.14.00133**

Surgical removal of a thrombus formed in the right atrium due to hemodialysis catheter

Alaa Hijazi[1], Hülya Çiçekcioğlu[2], Ferit Çiçekçioğlu[1], Salih Fehmi Katırcıoğlu[3]

[1)] Department Of Cardiovascular Surgey, Turkey Yuksek Ihtisas Education And Training Hospital, Ankara, Turkey
[2)] Department Of Cardiology, Ankara Numune Education And Training Hospital, Ankara, Turkey
[3)] Department Of Cardiovascular Surgey, Etlik Ihtisas Education And Training Hospital, Ankara, Turkey

Summary

Abstract: Insertion of hemodialysis catheter is widely performed for patients with chronic renal failure. Right atrial thrombus formation is one of the serious and rare complications of indwelling catheter. Herein we a present a chronic renal failure patient who had an indwelling catheter induced right atrial thrombus. Thrombectomy was performed on cardiopulmonary bypass and the postoperative course was uneventful.

Keywords: Right atrial thrombus, indwelling catheter, chronic renal failure.

Introduction

Due to increased incidence of renal failure required hemodialysis; placement of hemodialysis catheters is widely performed for use in both the hospital and the outpatient setting. There are many conditions which may complicate this type of vascular access such as infection, hemorrhage, thrombus formation and stenosis of the vein in which the catheter is inserted. We a present a chronic renal failure patient who had an indwelling catheter induced right atrial thrombus. Thrombectomy was performed on cardiopulmonary bypass and the postoperative course was uneventful.

Case

A 48 year-old female patient came to our clinic suffering from palpitation. She had a chronic renal failure so a hemodialysis catheter was inserted into the right internal jugular vein 3 months ago in another hospital. She had no fever, blood pressure was 120/80 mmhg and heart rate 85 beats/min. The indwelling catheter was inserted into the right internal jugular vein. There was no pathological sign on the physical examination.

Please cite this article as: ***Hijazi A, Çiçekcioğlu H, Çiçekçioğlu F, Katırcıoğlu SF. Surgical removal of a thrombus formed in the right atrium due to hemodialysis catheter. EJCM 2014; 02 (2): 33-35. DOI: 10.15511/ejcm.14.00133***

Echocardiographic imaging revealed a 4.2 x 3.5cm mass adherent to the right atrial wall. 2 degree tricuspid regurgitation and a 70 mmhg systolic pulmonary artery pressure were observed. No sign of pulmonary thromboembolism was observed on the thorax tomography scanning. Right atrial thrombectomy was performed on cardiopulmonary bypass. The tricuspid valve was intact. The postoperative course was uneventful.

Discussion

The formation of a thrombus around the intracardiac end of an indwelling catheter is a rare condition. On opening the right atrium we found the indwelling catheter around which a thrombus was formed. The thrombus was fragile, white-pinkish, organized, cauliflower shape and lobulated so we mixed it with a myxoma (**Figure.1**). The end of the catheter was adhered to the wall of the right atrium, so we believe that an endothelial damage induced by trauma predisposed to platelet aggregation and thrombus formation. The spacemen was cultured and no micro-organism was colonized. Indwelling catheter induced right atrial thromboses is difficult to detect on the basis of clinical signs.

a prospective study of 32 consecutive autopsies of patients who died with balloon-tipped, flow- directed right heart catheter in place Alfred and associates found that 29% of 55 patients who died within one month of catheterization had right sided endocardiac lesions (thrombus or hemorrhage) and 4 of these had infective endocarditis. Chastre et al found internal jugular vein thrombosis by venography or at post-mortem examination in 22 of 33 (66%) consecutive patients immediately following removal of thier right heart.[1] Right atrial Thrombectomy has been reported to be associated with a lower mortality compared with conservative management with anticoagulation and antibiotics; however, this may reflect selection bias, with more stable patients undergoing surgery.[2] It has been suggested that if the thrombus is small (<2 cm), anticoagulation is tried for 6 months followed by a repeat echo and catheter removal.

In the presence of bacteraemia, the catheter would be removed first followed by anticoagulation. If the thrombus is larger than 2 cm, especially in the presence of infection, urgent thrombectomy together with antibiotics and anticoagulation should be considered.[2] In this case the thrombus was about 4x4 cm and fortunately she did not suffer from any fever or bacteraemia.

Administration of anticoagulant into this patient could lead to pulmonary thromboembolism and get the situation deteriorated. We suggest performance of echcardiographic scanning on patients requiring long period indwelling catheter on the central veins and right side of the heart for early diagnosis and intervention of any intracardiac thrombus.

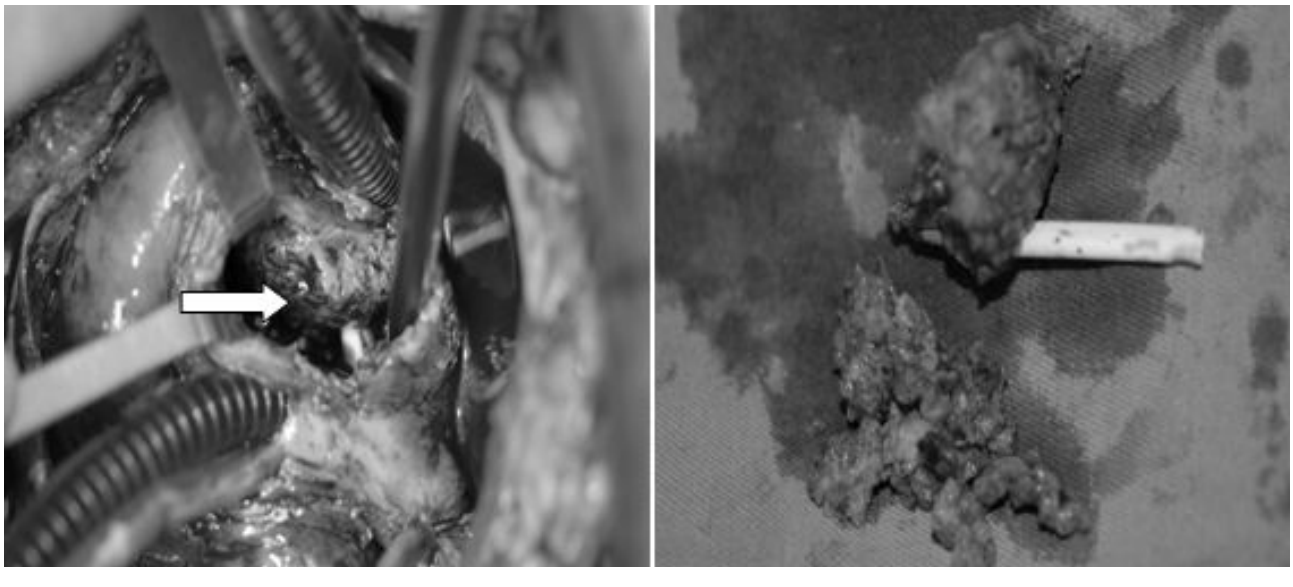


Figure 1. *(Legend) The thrombus (arrow) formed around the indwelling catheter within the right atrium (left), the thromus and the tip of the catheter after being excised (right).*

References

1. AF Connors, Jr, R J Castele, N Z Farhat and JF Tomashefski. Complications of right heart catheterization. A prospective autopsy study. *Chest* 1985;88;567-572. DOI 10.1378/chest.88.4.567

2. Negulescu O, Coco M, Croll J, Mokrzycki MH. Large atrial thrombus formation associated with tunnelled cuffed haemodialysis catheters. *Clin Nephrol* 2003; 59: 40–46

Received: 21/11/2013
Accepted: 18/07/2014
Published: 15/09/2014

Disclosure and conflicts of interest:
Conflicts of interest were not reported.

Corresponding author:
Dr. Alaa Hijazi
dralaahj@yahoo.com

Received: 14/12/2013 **Accepted:** 22/03/2014 **Published:** 15/09/2014

EJCM 2014; 02 (2): 36-38 **Doi: 10.15511/ejcm.14.00139**

Massive pulmonary embolism with extreme hypoxia and hypocarbia caused by knee bandage in young male

Umit Yasar Sinan[1], Ugur Coskun[1], Gurkan İmre[1], Cem Bostan[1], Okay Abaci[1], Cuneyt Kocas[1], Sukru Arslan[1], Onur Baydar[1], Veysel Oktay[1], Serdar Kucukoglu[1]

[1)] Istanbul University Institute of Cardiology, Cardiology Department, Istanbul, Turkey

Summary

Pulmonary embolism (PE) caused by obstruction of the pulmonary arterial bed is an acute, life threatening, cardiovascular emergent situation. It is a reversible cause of right ventricular failure. The initial diagnosis majority may be missed due to symptoms and signs are nonspecific. Because of late detection of diagnosis is fatal, PE should be thought when acute dyspnea occurs. PE and deep vein thrombosis (DVT) are clinical situations related to venous thromboembolism (VTE). PE accompanies 50% to DVT.[(1)] The real incidence of DVT and PE is not known due to nonspecific clinical situation. Pulmonary embolism occurs in 0.4% of hospitalized patients.[(2)]

Keywords: Pulmonary embolism, deep vein thrombosis, ventricular failure.

Case

A 34 years old professional basketball player was admitted to our emergency service with ambulance service due to acute dyspnea. The dyspnea had started suddenly after basketball training and the general condition of the patient has rapidly deteriorated. The patient had an injury of left knee anterior cruciate ligament two month ago. A knee bandage had been advised by an orthopedist. Except this injury there was no special characteristic on his background. On physical examination, he was unconscious and extremely cyanotic. He had severe dyspnea and tachypnea. First and second heart sound were normal, but there was right ventricular third heart sound (S3) and jugular venous distention. The blood pressure was 80/50 mmHg. The ECG

Please cite this article as: ***Sinan UY, Coskun U, İmre G, Bostan C, Abaci O, Kocas C, Arslan S, Baydar O, Oktay V, Kucukoglu S. Massive pulmonary embolism with extreme hypoxia and hypocarbia caused by knee bandage in young male. EJCM 2014; 02 (2): 36-38. DOI: 10.15511/ejcm.14.00136.***

showed S1Q3T3 pattern. There was a bandage on his left knee. Also on the left thigh there was swelling and stiffness. The artery blood gas showed extreme hypoxia, hypocarbia and deep acidosis (**Figure 1**).

On laboratory examination D-dimer was extremely high. Transthoracic echocardiography (TTE) revealed right ventricular dilatation (RV diameter:3.47 cm), systolic dysfunction (TAPSE:0.92 cm and tricuspid valve lateral annulus systolic velocity:0.7 cm/sec) , and high estimated systolic pulmonary artery pressure (sPAP:55 mmHg) (**Figure 2 and 3**). Finally we suspected strongly acute pulmonary emboli. The patient was considered at high risk of PE due to hemodynamic instability. So we decided urgently to start intravenous thrombolytic therapy. He was intubated because of poor blood gasses results. 100 mg t-PA was given in two hours. Unfractionated heparin (UFH) was started with t-PA and continued after thrombolytic therapy. After thrombolytic therapy the hemodynamic situation and artery blood sample were improved (**Figure 4**). The patient was extubated.

When he was stable, pulmonary CT angiography was performed. Huge thrombus bulks were observed in both the pulmonary artery and distal branches. Warfarin was started to patient. Bilateral lower extremities venous Doppler and coagulation parameters (Factor Leiden V, protein C and S etc.) were normal. So we thought that the PE was secondary to venous blood restriction by knee bandage and decided to give warfarin therapy for six months. The patient was discharged without complaint to be followed up as outpatients.

Figure 1. *Initial blood gases results.*

Discussion

Pulmonary embolism (PE) caused by obstruction of the pulmonary arterial bed is an acute, life threatening,

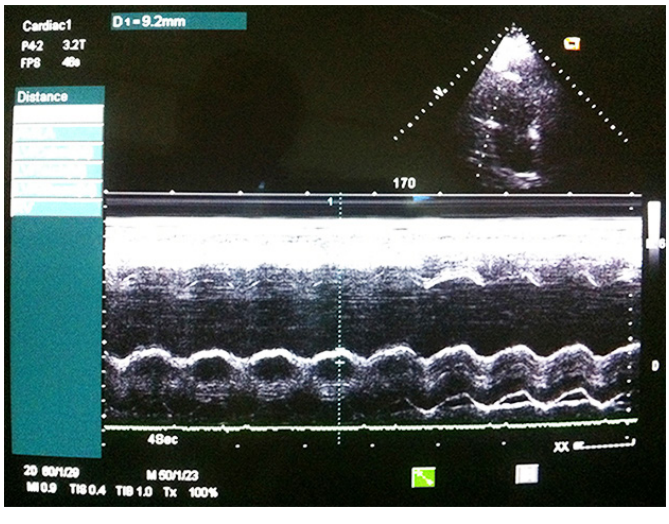


Figure 2. *Right ventricular enlargement in transthoracic echocardiography parasternal long axis view.*

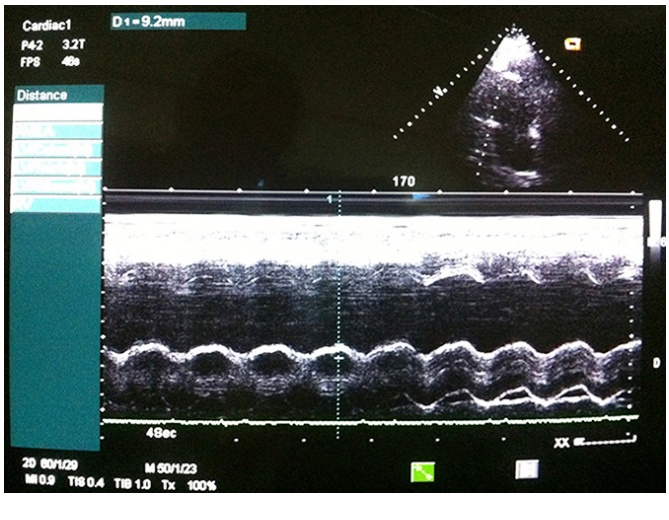


Figure 3. *Decreased TAPSE in transthoracic echocardiography.*

Please cite this article as: ***Sinan UY, Coskun U, İmre G, Bostan C, Abaci O, Kocas C, Arslan S, Baydar O, Oktay V, Kucukoglu S. Massive pulmonary embolism with extreme hypoxia and hypocarbia caused by knee bandage in young male. EJCM 2014; 02 (2): 36-38. DOI:*** **10.15511/ejcm.14.00136.**

cardiovascular emergent situation. PE and deep vein thrombosis (DVT) are clinical situations related to venous thromboembolism (VTE). On patients who admitted to the clinic with PE, DVT is the underlying cause of %70 as a result of further investigations.[3]

Figure 4. *After thrombolytic therapy and extubation blood gases results.*

In the presence of a number of predisposing factors that facilitate the exit is called secondary PE. If there is any underlying cause is called idiopathic PE. Compose 20% of all cases were idiopathic PE according to ICOPER.[4] Facilitating factors that are associated with the patient or conditions include certain; advanced age, prior VTE, active malignancy, neurological disease with extremity paralysis such as heart disease and respiratory failure situations that require a long time immobilization, congenital or acquired thrombophilia, hormone replacement therapy (HRT) or combined oral contraceptive treatment, hip or leg fracture, hip or knee joint replacement, major surgery and trauma.[5]

Conclusion

In our patient there was no any immobilization history. But he had history of knee injury. Although it did not cause immobilization there was a bandage on his knee which restricting venous blood flow. So we keep in mind that deep vein thrombosis and PE may be occurred without immobilization.

References

1. Moser KM, Fedullo PF, Littejohn JK, Crawford R. Frequent asymptomatic pulmonary embolism in patients with deep venous thrombosis. *JAMA* 1994;271:223–5.
2. Stein PD, Beemath A, Olson RE. Trends in the incidence of pulmonary embolism and deep venous thrombosis in hospitalized patients. *Am J Cardiol* 2005;95:1525–6.
3. Dalen JE. Pulmonary embolism: what have we learned since Virchow? Natural history, pathophysiology, and diagnosis. Chest 2002;122:1440–56.
4. Goldhaber SZ, Visani L, De Rosa M. Acute pulmonary embolism: clinical outcomes in the International Cooperative Pulmonary Embolism Registry (ICOPER). *Lancet* 1999;353:1386–9.
5. Guidelines on the diagnosis and management of acute pulmonary embolism. *European Heart Journol* 2008;29:2276-315.

Received: 14/12/2013
Accepted: 22/03/2014
Published: 15/09/2014

Disclosure and conflicts of interest:
Conflicts of interest were not reported.

Corresponding author:
Dr. Umit Yasar Sinan
umityasarsinan@gmail.com

E Journal of Cardiovascular Medicine
is a global e-journal targeting articles on:

- **clinical cardiology,**
- **interventional cardiology,**
- **arrhythmia,**
- **cardiovascular surgery,**
- **vascular & endovascular surgery,**
- **vascular biology**