Value of Bronchial Artery Embolization in Management of Massive Hemoptysis

Oday abdulhadi jassim[1], Marwah adel mahdi[2], Israa jarjees rasheed saeed[3]
[1] medical city hospital, Baghdad, Iraq.odayjassim1978@yahoo.com
[2] Ibn Albaladi hospital for women and children, Baghdad, Iraq. marwaadil2017@gmail.com
[3] Radiology institute, Nineveh Health directorate, Nineveh, Iraq.israajarjees2@gmail.com

Abstract

Background: hemoptysis confers a great morbidity on patients' quality of life, and depending on its cause, some patients may be unfit for open thoracotomy surgeries, so interventional radiology here offers a very promising alternative as a less traumatic, more convenient way of treating such patients, although on the expense of relatively high technical demands. Aim of the study: To assess the main findings and possible outcomes of patients suffering from hemoptysis and treated by bronchial artery embolization. Patients and methods: Patients were retrospectively evaluated from September 2015 to January 2017, 14 patients (8 males and 6 females) referred to Babel center of cardiac catheterization & surgery complain from massive hemoptysis. Results: The most common cause of hemoptysis was TB, followed by bronchiectasis. Non-bronchial systemic arteries, which were observed in five (35.71%) patients. Two patients had left internal mammary, two patients had Left thyrocervical trunk, and only one had Left fifth intercostal artery. The most common angiographic vascular patterns were a combination of Neovascularity/ hypervascularity and Hypervascularity/ hypertrophy. There were no complications recorded during or after the embolization, also there was 100% technical success rate. The recurrence rate of hemoptysis during one month was 21.43%, and the same rate was observed after three months. Conclusions: Interventional radiology is an evolving branch in Iraq, and this study showed promising results. There was a high technical success rate associated with relatively high recurrence rate.

Keywords: Bronchial Artery, Embolization, Management, Massive Hemoptysis.

1. Introduction

Massive hemoptysis is generally used to describe the expectoration of a large amount of blood and/or a rapid rate of bleeding, although the precise thresholds that constitute massive hemoptysis are controversial [1, 2]. We define massive hemoptysis as either ≥500 mL of expectorated blood over a 24-hour period or bleeding at a rate ≥100 mL/hour, regardless of whether abnormal gas exchange or hemodynamic instability exists [3]. Systemic no bronchial collateral arteries not have this design, instead next a transpleural sequence or possibly rise through the inferior pulmonary ligament, never connection the bronchial tree. Abnormal anatomy additional public in patients with cystic fibrosis. Nonbronchial collaterals examined and treated parallel with the hypertrophied bronchial arteries at the period of primary arteriogram [4, 5]. Huge hemoptysis more due to progressive "bronchiectasis, lung cancer, pulmonary tuberculosis, and lung abscess". The causes depends on the demography of the people. Tuberculosis still the cause of huge hemoptysis global [2]. More recently, iatrogenic causes of massive hemoptysis have increased in frequency; these include bleeding following a transbronchial biopsy or transthoracic needle biopsy or bleeding from a ruptured pulmonary artery caused by SwanGanz catheter placement [6]. Contraindications for bronchial artery embolization (BAE) are "uncorrectable coagulopathy, renal failure, and severe contrast allergy". In inherited pulmonary artery stenosis, the bronchial collateral vessels may deliver a vital part in pulmonary parenchymal perfusion, so cautious concern and pediatric cardiology discussion is authoritative before management [7]. Embolotherapy is the first-line treatment for massive hemoptysis or recurrent intractable hemoptysis. Presence of a major spinal artery branch or radiculomedullary (intercostal arteries can contribute to spinal medullary arteries from the right intercostobronchial trunk) branch from the bronchial artery is considered to be a contraindication to embolotherapy by some interventionalists, but others perform embolization if a microcatheter can be negotiated well beyond such a vessel [8, 9]. The aim of study is to assess the main findings and outcomes of patients suffering from hemoptysis and treated by bronchial artery embolization.

2. Method

Patients were retrospectively evaluated from September 2015 to January 2017, 14 patients (8 males and 6 females) referred to Babel center of cardiac catheterization & surgery complain from massive. Assessment of severity of hemoptysis was based on clinical criteria, and laboratory parameters. These parameters include Chest CT, CBC, VIROLOGY, RFT and I.N.R. All patients receive conservative management which consisting of maintaining airways, breathing and circulation

Procedure and technique: Equipment Table [10]

1. Catheters
2. Pull down (reverse) shapes (mikaelson, shepherd shock, simmons)
3. Forward-looking shapes (cobra, rosch celiac, headhunter)

doi.org/10.31838/hiv22.02.55 Received: 13.01.22, Revised: 15.04.22, Accepted: 05.08.22

4. Micro catheters
5. Nonionic contrast
6. Embolic agents:
7. Particles (polyvinyl alcohol , 300-500 micro m
8. Coils (for emergent proximal embolization).
9. Gelfoam (temporary agent)
10. Avoid liquid agents , glue

Polyvinyl alcohol elements are favored to gelatin sponge pledgets due to the pledgets are resorbable [11]. Microspheres described as effective embolization substantial [12]. To prevent injury to small collaterals arteries and increase the risk of aortic, esophageal, bronchial, or pulmonary artery wall necrosis, embolic agents avoided. Coils prevent to reservation entree to sites of bronchial hemorrhage and permit remanagment of injured vessel [8]. Proximal coil location restrictions upcoming embolizations to usually gradually lesser and fewer nearby collateral vessels. Coils important in the treatment of arterial aneurysms or pseudoaneurysm [13].

After proper preparation and draping, under local anasthesia, arterial femoral sheath 6Fr is placed in Rt. common femoral artery, using a 5 Fr cobra II catheter, with a 0.0035 hydrophic guidewide with curved end. Catheterization of bronchial arteries start in descending aorta at level of Lt. main bronchus, selective injection of both Rt. & Lt. bronchial arteries done and then search for possible systemic non bronchial supply by catheterization of internal mammary, intercostal or costocervical arteries. Catheterization & embolization are usually guided by preoperative CT chest finding or bronchoscopic evaluation.Other catheters used are multiporpose 5Fr and Simmon II 5Fr catheters.

Angiographic finding in hemoptysis

1. Neovascularization
2. Hypervascularity
3. Hypertrophic and tortous bronchial arteries
4. Shunting from bronchial to pulmonary arteries
5. Bronchial artery pseudoaneurysm
6. Extravasation(rare).
7. Bronchial arteries larger than 2-2.5mm in diameter are considered enlarged

Results

This study included forteen patients (8 male and 6 females) who suffered from massive hemoptysis, their age ranged from 34-71 years.

The most common cause of hemoptysis was TB, followed by bronchiectasis, and then one case for both lung cancer and aspergillosis.

Table (1): the causes of hemoptysis		
The cause	**Number**	**%**
TB sequelae	8	57.14
Bronchiectasis	4	28.57
Lung cancer	1	7.14
Aspergillosis	1	7.14
Total	14	100.0

Regarding right bronchial artery, most of the cases had one intercostobronchial trunk, and 35.71% had intercostobronchial trunk+ 1 vessel. Most of the patients had left bronchial artery with two trunks (64.29%) rather than one trunk (35.71%).

Table (2): Anatomical variation of bronchial tree		
Type	**Number**	**%**
Right bronchial artery		
Intercostobronchial trunk	9	64.29
Intercostobronchial trunk + right inferior bronchial artery	5	35.71
Left bronchial artery	Number	%
Sup. and inf. branches	9	64.29
Single trunk	5	35.71
Total	14	100.0

Other anatomical findings in hemoptysis included non-bronchial systemic arteries, which were observed in 5 (35.71%) patients. Two patients had left internal mammary, two patients had Left thyrocervical trunk, and only one had Left fifth intercostal artery.

Table (3): Non-bronchial systemic arteries		
Findings	**Number**	**%**
Left internal mammary artery	2	40.0
Left thyrocervical trunk	2	40.0
Left fifth intercostal artery	1	20.0
Total	5	100.0

The detailed angiographic findings listed in Table (4), but the most common observations were a combination of Neovascularity/ hypervascularity and Hypervascularity/ hypertrophy.

Table (4): Angiography finding		
Findings	**Number**	**%**
Neovascularity/ hypervascularity	6	42.86
Hypervascularity/ hypertrophy	6	42.86
Hypervascularity/ hypertrophy/ Neovascularity	1	7.14
Neovascularity/ hypervascularity/ pseudoaneurism	1	7.14
Total	14	100.0

There were no complications recorded during or after the embolization, also there was 100% technical success rate. The recurrence rate of hemoptysis during one month was 21.43%, and the same rate was observed after three months.

Table (5): Clinical recurrence rate		
Recurrence	**Number**	**%**
During one month	3	21.43
After three months	3	21.43
No recurrence	8	57.14
Total	14	100%

3. Discussion

In the current study, the most common cause for hemoptysis in the 14 patients (8 males , 6 females) who required angiographic embolization was Tuberculosis sequelae (57.14%), followed by bronchiectasis (28.57%), then lung cancer and aspergillosis (7.14%). This finding disagreed with studies done in developed countries of Europe; Dabó et al. [14] in Portuguese, who studied a total of 88 cases that under gone bronchial artery embolization during one year, and reported bronchiectasis in 35 (38.0%) and Tuberculosis sequelea in 33

(37.5%) then aspergillosis in 12(13.6%) and Lung cancer in2(2.3%). Also Fartoukh et al. [15] in France who studied the causes of massive hemoptysis in 1,174 patients, and TB was the cause in only 25% of them. While in studies done in Asia, the results showed higher prevalence of TB; Bhalla et al. [16] in India who studied causes and outcomes of massive hemoptysis in 64 patients, TB was the commonest cause (65%), similarly another study in India done by Singh et al. [17], reported TB prevalence as cause for hemoptysis of 60%. It is estimated that there are 20,000 TB patients in Iraq (only 7,853 cases were notified), with more than 4,000 deaths due to TB annually [18]. In Iraq, a study done by Al-Hilali [19] in Karbala, to study the causes of hemoptysis in outpatient clinics, reported that TB was the etiologic factors in 20% of cases. These figures might justify the high rate of TB that required bronchial artery embolization to stop the hemoptysis in the current study. In regards to the mechanism for developing hemoptysis in TB patients, the latter is regarded as a manifestation of active disease, or caused by complication that is cause by Rasmausian aneurysm , like cavitations, fibrosis, bronchiectasis, or mycetoma [20]. Almost 10% of patients with lung cancer are at risk for developing massive hemoptysis [21], and stopping the bleeding is necessary, but it is only a part of management in patients with lung cancer, and with recent advances in treatment of those patients, their survival rate are increasing, together with possible complications like hemoptysis [22]. Aspergillosis in the form of chronic pulmonary aspergillosis may be complicated by massive hemoptysis, and have relatively high recurrence rate (≈55 percentage), also after controlling the bleeding active treatment should be started to effectively control the disease [23]. In the current study, the most common pattern of bronchial arteries were one right and two left bronchial arteries, which disagreed with Yener et al. [23] who studied 551 bronchial arteries (208 patients), and reported that the combination of one right intercostal-bronchial trunk and one left bronchial artery was the most common. While our results agreed with Hinganu et al. [24] who studied the bronchial vascular anatomy of 18 cases, and reported that the most common variation was 2 bronchial arteries in the left lung and 1 to the right.

In the current study, 5 (35.71%) non bronchial systemic artery giving blood supply to bronchial tree and causing hemoptysis in addition to original bronchial arteries, namely; internal mammary artery, thyrocervical trunk, and one from the fifth intercostal artery. If these aberrant vessels went undetected before bronchial artery embolization, it may results in unsatisfactory results (failure or recurrence), with varying prevalence from 8% reaching 35% in patients with massive hemoptysis, so in order to have perfect outcomes high index of suspicion is needed in those patients [25]. In the current study, the most common angiography finding were hypervascularity, hypertrophy and neovascularization. This agreed to the results of Lee et al. [26]. These findings could be beneficial in localizing the bleeding site if it was absent during bronchial artery angiography. In the current study, the immediate technical success rate and was 100%, this was comparable to the results of Tom et al. [27] who studied the results of 97 bronchial artery embolizations for treating hemoptysis, and reported a technical success rate of 90%. The reported clinical success rate raged from 82% to 98%. The high success rate in this study could be explained by the cautious selectivity of candidates to bronchial artery embolization, as it is still a relatively newly introduced in Iraq, and is performed in limited centers throughout the country.

4. Conclusion

Interventional radiology is an evolving branch in Iraq, and this study showed promising results. There was a high technical success rate associated with relatively high recurrence rate.

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