นิพนธ์ต้นฉบับ

SVC syndrome in King Chulalongkorn Memorial Hospital

Harit Suwanrusme* Virot Sriuranpong*
Kanjana Apinonkul** Narin Voravud***

Suwanrusme H, Sriuranpong V, Apinonkul K, Voravud N. SVC syndrome in King Chulalongkorn Memorial Hospital. Chula Med J 1998 Dec; 42(12): 1079-90

Objective : *To determine clinical features, diagnostic and therapeutic outcome of SVCs in Chulalongkorn Hospital*

Setting : *Medical Oncology Unit, Department of Internal Medicine, Faculty of Medicine Chulalongkorn University.*

Design : *Descriptive clinical study*

Patients/Material : *Clinical records of 28 SVCs cases treated at the Medical Oncology Unit from 1992-1995.*

Methods : *A review of all clinical records of 28 SVCs cases was carried out to determine the patient characteristics, presenting symptoms and signs, diagnostic and treatment methods*

Results : *There were 24 males and 4 females SVCs patients. Median age was 52.0 years (16-80). Seven patients (25%) were less than 35 years old. SVCs was the presenting symptom of underlying malignancy in 23 cases (82.11%). Typical symptoms included facial swelling 96.4%, arm swelling 78.5%, dyspnea 78.5%, and cough 64.3%. Less common symptoms were chest pain 17.9%, head pullness 39.3%, hoarseness 25.0%, dysphagia 7.1%, hemophysis 3.6% and syncope 3.6%. The frequent clinical findings were facial swelling 69.4%, increased collateral veins of the anterior chest wall 87.3%, venous distention of neck 82.1% and swelling of arms 78.5%. Common chest*

* Recident, Department of Medicine, Faculty of Medicine, Chulalongkorn University

** Department of Radiology, Faculty of Medicine, Chulalongkorn University

***Department of Medicine, Faculty of Medicine, Chulalongkorn University

roentgenograph findings were right hilar mass (57.1%), mediastinal widening (50.0%), and plural effusion (42.8%). CAT scan of chest was performed in 19 patients which all yielded positive findings. Bronchoscope examination yielded positive in 2 of 7 cases. Fine needle aspiration biopsy had postive result in 10 of 13 cases. The most common etiology was lung cancer. In the younger aged group (< 35 years), treatable malignancies were the important causes, such as germ cell tumor (4/7) and lymphoma (2/7). 8 of 9 patients responded to concurrent chemoradiation. 6 of 8 respounded to chemotherapy alone. And only 3 of 9 responded to radiation treatment alone. According to histology, 7 of 1 2 non-small cell lung cancer, 5 of 6 small cell lung cancer, and 3 of 6 germ cell tumor responded to treatment. The overall response rate was 64.3%. The overall median survival time calculated by Kaplan-Meier's method was 10.9 weeks.

Conclusion : *The majority of SVCs patients in this study were non-small cell lung cancer patients. Younger patients had more chemosensitive malignancies such as germ cell tumor and lymphoma. Establishment of the extent of disease in the chest by imaging technich and a pathological diagnosis were crucial prior to a ppropiate therapy with either radiation or chemotherapy or both. FNA was an important diagnostic procedure with a high positive yield. Response to treatment depended on the underlying malignancies.*

Key word : *Superior vena cava syndrome.*

Reprint request: Voravud N, Department of Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand.

Received for publication. October 15, 1998.

หฤษฎ์ สุวรรณรัศมี, วิโรจน์ ศรีอุพารพงศ์, กาญจนา อภินนท์กุล, นรินทร์ วรวุฒิ. ภาวะอุดกั้นหลอดเลือดดำ ซูพีเรียร์ วีนา คาวา ในโรงพยาบาลจุฬาลงกรณ์. จุฬาลงกรณ์เวชสาร 2541 ธ.ค; 42(12): 1079-90

วัตถุประสงค์ : *เพื่อศึกษาลักษณะทางคลินิค การวินิจฉัย และผลการรักษาภาวะอุดกั้นหลอดเลือดดำ ซูพีเรียร์ วีนา คาวา ในโรงพยาบาลจุฬาลงกรณ์*

สถานที่ทำการศึกษา : *หน่วยมะเร็งวิทยา, ภาควิชาอายุรศาสตร์ คณะแพทยศาสตร์, จุฬาลงกรณ์มหาวิทยาลัย*

รูปแบบการศึกษา : *การศึกษาเชิงบรรยาย*

ผู้ป่วยที่ทำการศึกษา : *ข้อมูลจากเวชระเบียนผู้ป่วย จำนวน 28 ราย ที่มีภาวะอุดกั้นหลอดเลือดดำ ซูพีเรียร์ วีนา คาวา ซึ่งได้รับการรักษาในหน่วยมะเร็งวิทยาตั้งแต่ พ.ศ. 2535 – 2538*

วิธีการศึกษา : *โดยรวบรวมและวิเคราะห์ข้อมูลทางคลินิคของผู้ป่วยเพื่อศึกษาลักษณะผู้ป่วย อาการ และอาการแสดง การวินิจฉัย และการรักษา*

ผลการศึกษา : *ผู้ป่วยชาย 24 ราย หญิง 4 ราย ซึ่งมีภาวะอุดกั้นหลอดเลือดดำ ซูพีเรียร์ วีนา คาวา อายุเฉลี่ย 52 ปี (16 – 80) มี 7 ราย อายุน้อยกว่า 35 ปี ภาวะนี้เป็นอาการนำของโรคมะเร็งในผู้ป่วย 23 ราย (82.11%) อาการบ่งชี้สำคัญประกอบด้วย หน้าบวม 96.9%, แขนบวม 78.5%, หายใจลำบาก 78.5% และ ไอ 64.3% อาการที่พบน้อย เช่น เจ็บหน้าอก 17.9%, หนักศีรษะ 39.3%, เสียงแหบ 25.0%, กลืนลำบาก 7.1%, ไอเป็นเลือด 3.6% และหมดสติ 3.6% อาการแสดงที่ตรวจพบได้บ่อย เช่น หน้าบวม 69.4% การขยายตัวของหลอดเลือดดำบริเวณผนังทรวงอกส่วนหน้า 87.3% การคั่งของหลอดเลือดดำบริเวณคอ 82.1% และแขนบวม 78.5% ลักษณะภาพรังสีทรวงอกที่พบบ่อยคือ ก้อนบริเวณขั้วปอดขวา 57.1% เมดิแอสตินัมกว้าง 50% และน้ำในช่องปอด 42.8% การทำเอ็กซ์เรย์คอมพิวเตอร์ของทรวงอกในผู้ป่วย 19 ราย ทุกรายแสดงให้เห็นพยาธิสภาพ การส่องกล้องตรวจทางหลอดลมได้ผลการวินิจฉัย 2 รายจาก 7 ราย การเจาะดูดชิ้นเนื้อด้วยเข็มได้ผลการวินิจฉัย 10 จาก 13 ราย สาเหตุที่พบบ่อยที่สุดได้แก่มะเร็งปอด ในผู้ป่วยอายุน้อยกว่า 35 ปี จะพบมะเร็งที่ตอบสนองดีต่อการรักษา เช่นเนื้องอกเจิร์มเซลล์ (4/7) และมะเร็งของเนื้อเยื่อต่อมน้ำเหลือง (2/7) ผู้ป่วย 8 ใน 9 ราย ตอบสนองต่อการรักษาด้วยเคมีบำบัดร่วมกับรังสีรักษา 4 ใน 8 ราย ตอบสนองต่อเคมีบำบัดอย่างเดียว มีผู้ป่วยเพียง 3 ใน 9 ราย ที่ตอบสนองต่อรังสีรักษาเพียงอย่างเดียว*

เมื่อพิจารณาจากลักษณะทางเนื้อเยื่อมะเร็งปอดชนิดไม่ใช้เซลล์ขนาดเล็ก 7 ใน 12 ราย ชนิดเซลล์ขนาดเล็ก 5 ใน 6 ราย และเนื้องอก เจริ์มเซลล์ 3 ใน 6 ราย ตอบสนองต่อการรักษา อัตราการตอบสนองต่อการรักษา โดยรวม 64.3% ระยะเวลารอดชีวิต (มัธยฐาน) คำนวนโดยวิธีคาแปลนเมเยอร์ คือ 10.9 สัปดาห์

สรุป : *สาเหตุสำคัญของภาวะอุดกั้นหลอดเลือดดำ ซูพีเรียร์ วีนา คาวา ในการศึกษานี้ คือมะเร็งปอดชนิดไม่ใช้เซลล์ขนาดเล็ก ผู้ป่วยอายุน้อย จะพบมะเร็งที่ตอบสนองดีต่อเคมีบำบัดมากกว่า เช่น เนื้องอกเจริ์มเซลล์และมะเร็งเนื้อเยื่อน้ำเหลือง การวินิจฉัยการลุกลามของพยาธิสภาพในทรวงอก โดยเทคนิคทางรังสีวิทยา และการตรวจชิ้นเนื้อทางพยาธิวิทยา มีความสำคัญเพื่อนำไปสู่การรักษาที่เหมาะสม ไม่ว่าโดยรังสีรักษาและ/หรือ เคมีบำบัด การวินิจฉัยในการใช้เข็มเจาะกระดูกเนื้อเยื่อเป็นวิธีที่ได้ประโยชน์สูง การตอบสนองต่อการรักษาขึ้นอยู่กับโรคมะเร็งที่เป็นสาเหตุเป็นสำคัญ*

The superior venacava syndrome (SVCs) is characterized by edema of the head, neck, arms, and upper trunk with dilated collateral veins and is often accompanied by cyanosis, dyspnea, headache and altered mental status. It causes significant morbidity and mortality from cerebral edema, reduced cardiac output, and upper airway obstruction which requires rapid diagnosis and treatment by the physician.[1] Over the years, the picture of SVCs has changed since the original etiologic classification presented by McIntire and Sykes in 1949[2] in which they concluded that one third of the cases were due to primary intrathoracic tumors, one-third to aortic aneurysms, and the remaining third to chronic mediastenitis and a number of less frequent conditions. Many later review have shown a steady decline in the number due to aortic aneurysms and alarming increases in the number due to malignancy, both primary lung cancer and mediastinal malignancy. Because SVCs is generally regarded as an oncologic emergency, therapy is often initiated before a diagnosis is firmly established. More over, invasive diagnostic procedures are considered hazardous by many, mainly because of excessive bleeding and respiratory complications.[3-6] There is controversy about the proper way of management, such as diagnostic procedures in obtaining histology and choices of treatment. We have reviewed the past 5 years experience with SVCs in Chulalongkorn Hospital to determine clinical features and diagnosis and therapeutic outcome.

Methods

A review of all clinical records of 28 SVCs cases in responsibility of Medical Oncology unit, Chulalongkorn Hospital was carried out to determine the patient characteristics, presenting symptoms and sign,chest x-ray appearance, method of diagnosis, causes of SVCs, and treatment and follow up between the years 1992 to 1995.

Result

Twenty-eightcases of SVCs were diagnosed from that period. There were 24 males (85.7%) and 4 females (14.3%), with an average age of 49.7 years (range from 16 to 80 years).

*Clinical presentation (Table 1-2)

In 23 of 28 patients (82.1%), the SVCs was the presenting symptom of their disease. The most common presenting symptoms consisted of facial swelling in 27 (96.4%), arm swelling in 22 (78.5%), followed by respiratory complaints, such as dysphea in 22 (78.5%) and cough in 18 (64.3%). Few patients had complaints of head fullness (11, 39.3%), hoarseness (7, 25%) or chest pain (5, 11.9%). Other less frequent-symptoms were dysphasia, hemopthysis and syncope.

Physical findings are summarized in table 2 and were generally associated with obstruction of the SVC: were facial edema in 27 patients (96.4%), increase collateral veins of anterior chest wall in 25 (89.3%), dilated neck vein in 23 (82.1%), and edema of the arms in 22 (78.5%). Airway obstruction and cyanosis were uncommon in our experience (14.3% and 3.6%).

Table 1. Age and sex.

Age	N	%
< 20	2	7.14
20-39	6	21.42
40-59	12	42.84
≥60	8	28.5

Mean age = 49.71 years Median = 52 years (16-80)

Table 2. Presenting symptoms.

	Chula, 1996		Yellin A, 1990	
	N	%	N	%
Facial swelling	27	96.4	54	85.7
Arm svwlling	22	78.5	0	31.7
Dyspnela	22	78.5	19	30.2
Cough	18	64.3	13	20.6
Head fullness	11	39.3	-	-
Hoarsness	7	25.0	1	1.6
Chest pain	5	17.9	4	6.3
Dysphagia	2	7.1	4	6.3
Hemopthysis	1	3.6	5	7.9
Syncope	1	3.6	-	-

The most common chest x-ray abnormality (Table 3) were right hilar masses in 16 (57.1%) and superior mediastinal widening in 14 (50%). Other abnormalities included plural effusion, anterior mediastinal mass, bilateral diffuse infiltration and cardiomegaly. No normal chest film was found in our patients.

The duration of symptoms before diagnosis of SVCs was 3.5 weeks in average. Most of the patients were diagnosed within 1 month since onset of symptoms.

Table 3. Clinical presentations.

	N	%
Facial edema	27	96.4
Increased collateral veins of the anterior cheat wall	25	89.3
Venous distention of neck	23	82.1
Edema of arms	22	78.5
Plethora of face	8	28.6
Stridor	4	14.3
Cyanosis	1	3.6

***Underlying conditions and diagnosis procedures.**

Causes of superior vena cava obstruction are summarized in Table 4. For the 27 patients who obtained tissue diagnosis all of the histopathologies were malignant. For the other case, there was no tissue diagnosis. No benign histology was detected in our series. Bronchogenic carcinoma accounted for more than half of the cases (19, 67.8%). The second common cause of the SVCs was primary mediastinal tumor (6, 21.4%) and non-seminomatous germ cell tumor was responsible for the majority of this group (4, 14.3%). Lymphoma was found in two cases (7.1%). In patients younger than 35 either, the course of SVCs was primary mediastinal tumor, germ cell tumor or lymphoma. In contrast older than 35, the major causes were primary lung cancer. (Table 5)

Table 4. Chest film N = 28.

	N	%
Rt hilar mass	16	57.1
Sup mediastinum widening	14	50.0
Plural effusion	12	42.8
Ant medaistinal mass	9	32.1
Bilateral diffuse infilltration	1	3.6
Cardiomegaly	1	3.6
Normal	0	0

C-T Chest 19 cases (67.8%) doiagnostic 19

Table 5. Type of malignancy.

Malignancy	Suwanrusme H. 1996		Yellin A. 1990	
	N	%	N	%
*1^0 Lung Cancer	19	67.8	30	47.6
- SCLC	6	21.4	4	-
- Squamous	4	14.3	6	-
- Adeno carcinoma	7	25.0	6	-
- Large cell	1	3.6	2	-
- Mixed SCLC + NSCLC 1	3.6	0	-	-
*1^0 Mediastinum tumor	6	21.4	4	6.3
- Germ cell (seminoma)	1	3.6	1	-
- Germ cell (non seminoma)	4	14.3	-	-
- Thymoma	1	3.6	2	-
- Esophageal carcinoma	-	-	1	1
*Lymphoma	2	7.1	13	20.6

Table 6. Age classification by type of malignancy.

	Age	
	0-35 yr	>35 yr
NSCLC	-	12
SCLC	-	7
Germ cell tumor	4	1
Lymphoma	2	-
Others	1	-
Unknown	-	1

For diagnosis of SVC, chest computerized tomography were performed in 19 (67.8%) which all yeilded positive findings. The most frequent invasive procedure that was done in our series appeared to be fine needle aspiration biopsy which have positive result in 10 of 13 cases. Bronchoscopy was performe less frequent and had surprisingly low positive yeild (2 of 7). Lymph node biopsy had positive result in 6 of 7 cases. Various other less common procedures were also helpful in establishing the diagnosis, thoracenthesis (2), plural biopsy (2), mediastinoscopy (2), and thoracotomy (1). (Table 7)

Table 7. Diagnostic procedures.

	Yellin A. 1990	
	N	Diagnostic
FNA	1	1
Bronchoscopy	13	8
Lymph node biopsy	7	5
BM biopsy + aspiration	-	-
Throacenthesis	3	2
Plural biopsy	-	-
Mediastinoscope	15	14
Thoracotomy	1	1

***Treatment and outcome**

Treatment is summarized in Table 8 specific treatments aiming to alleviate the symphoms of SVC consisted of radiation therapy alone (9, 32.1%) chemotherapy alone (8, 28.7%), or combinations of chemotherapy and radiation therapy (9, 32.1%). Treatment with steroids (17, 60.7%), diuretics (6, 21.4%) and fluid restriction (7, 25.0%) were also used as adjunctive therapies. The type of specific treatment depended on the diagnosis. Lymphomas were treated with a curative intention. Patients with bronchogenic carcinomas, where the goal was to alleviate symptoms, were offered radiotherapy, with or without chemotherapy. The combination of chemothearpeuctic agents or the amount of radiation were tailored according to the individoal tissue diagnosis. The overall response rate was 64.3% (18 cases).

Table 8. Treatment.

Treatment	N	%
Steroid	17	60.7
Diuretics	6	21.4
Restrict fluid	7	25.0
Chemotherapy only	8	28.7
Concomitant chemoradiation	9	32.1
Radiotherapy only	9	32.1

For the responsders, the time to subjective relief was 6.8 days in average, and for objective response, the average time to response was 12 days. According to histology, results there were 7 responders of 12 non-small cell lung cancers, 5 responders of 6 small cell lung cancers, and 3 responders of 5 germ cell tumors. When startified by treatment modality, 8 of 9

patients responded to combined chemotherapy and radiation, 6 of 8 patients responded to chemotherapy alone, and in the radiation therapy alone there were only 3 responders out of 9 patients. The outcome of SVCs cases is also shown in Table 9. Of the 28 patients, 14 died (50%), and of these, 9 died from their underlying malignancy, 5 died from other causes, including 1 death from treatment complication, febrile neutropenia. No patient died from SVCs. Six (21.4%) were alive at the end of reference period and 8 were lost to follow-up. The median survival time calculated by Kaplan-Meier's method for non-small cell lung cancer was 8.0 weeks, and for germ cell tumor was 20.29 weeks. The overall median survival time was 10.86 weeks. (Table 10)

Table 9. Outcome of different malignancies.

Etiology	N	Alive	Dead			Loss F/U	Rresponse	Non-response
		N						
			N	(W) Median survival	(W) Rage			
1. Lung Cancer	6	1	4	10.86	1.43-42.43	1	5	1
- SCLC	12	3	7	8	0.14-39.14	2	7	5
- NSCLC	1	1	-	-	11.71-31.14	-	1	-
2. Lymphoma	-	2	-	11.71	-	2	2	-
3. Germ cell	-	-	-	-	11.71-31.14	-	-	-
- NSGTC	4	1	1	20.29	-	2	3	1
- Seminoma	1	-	1	-	0.29-93.00	-	-	1
4. Thymoma	1	-	1	20.86	-	-	-	1
5. Undiagnose	1	-	-	-	-	1	-	1

Table 10. Treatment outcome.

N	Tratment	R	NR	Alive	Dead	Loss F/U	N
9	Chemo + XRT	8	1	2	6*	1	9
9	XRT only	3	6	2	4**	3	9
8	Chemotherapy	6	2	2	4***	2	8
2	Non XRT or Chemo	1	1	-	-	2	2

*3 died from other causes (in response group)

**1 died from other causes (in non response group)

***4 died from treatment complication (in response group)

Discussion

The superior venacava syndrome, first described by William Hunter in 1757 as a complication of a synphilitic aortitis,[7] may result from various mediastinal conditions. In the past the etiologies consisted of a great number of benign conditions, such as aortic anuerysms, tuberculosis, and chronic mediastinitis.[2, 8-10] Because of the declining incidence of benign conditions causing SVCs, as well as the increasing incidence of malignancies, the trend now has already shifted toward malignant conditions that constitute 85-90% of all cases.[11-13] The remaining benign conditions become a thrombosis related to intravenous catheter use rather than anurysms or granuloma that once were the causes.[14]

The most common malignant tumor causing SVCs in our series was, same as the finding in many articles, bronchogenic carcinoma.[11-14]

The common location of lung malignancy found in previous reports[11] and in this series was in the right lung which has a closer anatomical relationship to the superior vena cava.

About histological subtypes, small-cell lung cancers more often implicated. The average age at diagnosis of SVCs was 49.7 years, close to that for lung cancer. Using age 35 as a cut off point, no cases of lung cancer were found under that age. In the younger age group (<35), the etiologies were treatable malignancies, such as germ cell tumor and lymphoma. For unknown reasons. There was a prominent number of germ cell tumor (17.9%) in our series in comparable to others.[12, 14, 15] However, we can conclude that we have to obtain an accurate diagnosis espicailly in the younger age group because their causes are usually malignancies that can be successfully treated in curable aim.

The clinical diagnosis of SVCs can easily be made at bedside. Almost all of SVCs patients have symptoms from venous obstruction, with or without respiratory complaints. Emergency symptoms such as hemopthysis or syncope can be found but they are very rare. Cerebral edema that cause severe changes in mental status and other serios neurological manifestations called "wet brain syndrome"[8] was also never found in our series. The characteristic physical finding obviously seen is facial and upper trunk edema, distension of neck veins and collateral veins of the anterior chest wall. Stridor and cyanosis indicating airway obstructions were found in only few patients. From these findings, it seems that SVCs does not frequently cause true emergency conditions that leads to rapid deterioration of the clinical course. Our conclusion is confirmed by the outcome of our patients in which there were no deaths directly caused by the SVCs. The similar result that was reported by Schraufragle, et al[12] in 1971 raised a question wheater immediate radiotherapy was crucial for all SVCs cases or should tissue diagnosis be obtained in most cases before the beginning of treatment. They also commented that prior radiotherapy not only made subsequent surgery more difficult, but may also leave possible complications, thus immediate radiotherpy should be kept for the rare case of acute onset SVCs with documented serious neurologic complications not due to cerebral metastasis.[12]

The diagnosis procedures used in clinical practice include both invasive and non-invasive procedures. Chest X-RAY is the most common investigation, and gives much information. CT scans of chest more cleary demonstrate the obstruction of the superior vena cava by extrinsic mass or intravasclar

lession, and it can be used as a guide for fine needle aspiration biopsy. The most frequent invasive procedure used in our servies was FNA which had a high positive yield. Moreover, the FNA is not difficult to perform and has low complication rates. In contrast to Yellin A,[15] the broncoscopic examinations were done infrequently and had low positive yield, however the reason was unknown. Mediastinoscopy, which was the most common and high-yielding procedure in Yellin A. series, was also infrequently done. Supraclavicular lymphonode biopsy was also a useful diagnostic procedure, however there was a caution that an edematous supraclavicolar fat pad or thrombosed vin can be mistaken for an enlarged lymph node.[16] Complications in these various procedures occurred infrequently. Bleeding occurring during lymphnode biopsy or thoracotomy was easily controlled. Recent studied have confirmed the low morbidity rate associated with the diagnostic procedures.[12-14,17,18]

In general, the treatment of SVCs syndrome depends on the clinical situation in which it occurs. If the obstruction is acute, causing severe symptoms, or it is progressing rapidly, tissue diagnosis may be deferred and radiotherapy is the treatment of choice. Corticosteroids and diuretics have been tried under these circumstances, but we know of no controlled studies that justified their use and their value is probobly limited to the acute situation[14] ailment. Radiation therapy is one of major choices of treatments. It can be used either as a sole therapy or in combination with chemotheapeutic agents, the response rate seems to improve in our group treated with a combination of radiotherapy and chemotherapy as compare to previous study.[19, 20] The response to treatments also depends on the type of underlying malignancy. Lymphoma, small cell cancer, and germ cell tumor are examples of chemosensitive malignancies which may respond well to chemotherapy, even it is used as a single treatment. While non-small cell-lung cancer, which is relatively chemoresistant, may have higher response in combination treatment programs. The chemotherapeutic regimens were selected by the basis of using high activity cytoxic drugs in a particular disease, such as platinum-based chemotherapeutic regimens in non-small cell lung cancer. With proper management a high rate of symptomatic relief can be expected and even survival may approximate that of patients with similar diseases without SVCs.

In conclusion, SVC syndrome, mainly caused by malignant conditions of mediastinum should be considered as makers of local invasiveness of underlying malignancy. In general, SVC syndrome dose not oftern cause a severe clinical outcome, thus we will have time to obtain an accurate diagnosis before starting specific treatments. To achieve the best outcome, the treatment modality could be considered according to both severity of symptoms and underlying pathology. The vast majority of SVCs patients respond to treatments and among the responders, the survival time is seem to be similar for those patients of the same disease without SVCs.

References

1. Hussey HH, Kate S, Yater WM. The superior vena cava syndroms: report of 35 cases. Am Heart J 1946 Jan; 31(1): 1-26
2. McIntire FT, Sykes EM Jr. Obstruction of the superior vena cava: a review of the literature and report of two personal cases. Ann Intern

Med 1949 May; 30(5): 925-60

3. Carabell SC, Goodman RL. Oncologic emergencies: superior vana cava syndrome. In: Devita VT, Hellman S, Rosenberg SA, eds. Cancer. 2nd ed. Philadelphia: Lippincott, 1985: 1855-60
4. Northrip DR, Bohman BK, Tsueda K. Total airway occlusion and superior vena cava syndrome in a child with an anterior mediastinal tumor. Anerth Analg 1986 Oct; 65(10): 1079-82
5. Salsali M, Cliffton EE. Superior vena cava l obstrcution in carcinoma of lung. NY State J Med 1969 Nov 15; 69(22): 2875-89
6. Issa PY, Brihi ER, Janin Y, Slim MS. Superior vena cava syndrome in childhood: report of ten cases and review of the literature. Pediatrics 1983 Mar; 71(3): 337-41
7. Hunter W. The history of an aneurysm of the aorta with some remarks on aneurysm in general. Med Observ Inquir (Lond) 1957; 1: 323
8. Effler DB, Groves LK. Superior vena caval obstruction. J Thorac Carciovasc Surg 1962 May; 43(5): 574-84
9. Banker VP, Maddison FE. Superior vena cava syndrome secondary to aortic disease: report of two cases and review of the literature. Dis Chest 1967 Jun; 51(6): 565-62
10. Kamiya K, Nakata Y, Naiki K, Hayashi H. Superior vena caval syndrome. Review of the literature and a case report. Vasc Dis 1967 Feb; 4(1): 59-65
11. Sculier JP, Feld R. Superior vena cavaobstruction syndrome: recommendations for managemant. Cancer Treat Rev 1985 Sep; 12(3): 209-18
12. Schraufnage DE, Hill R, Leech JA, Pare JAP. Superior vena caval obstruction. Is it a medical emergency? Am J Med 1981 Jun; 70(6): 1169-74
13. Ahmann FR. A reassessment of the clinical implications of the superior vena cava syndrome. J Clin Oncol 1984 Aug; 2(8): 961-9
14. Parish JM, Marschke RF Jr, Dines DE, Lee RE. Etiologic considerations in superior vena cava syndrome. Mayo Clin Proc 1981 Jul; 56(7): 407-13
15. Nieto AF, Doty DB. Superior vena cava obstruction, clinical syndrome, etiology, and treatment. Curr Probl Surg 1986 Sep; 10 (9): 442-84
16. Salsali M, Cliffton EE. Superior vena cava obstruction with lung cancer. Ann Thorac Surg 1968 Nov; 6(5): 432-437
17. Adar R, Rosenthal T, Mozes M. Vena caval obstruction: some epidemiological observations in 76 patients. Angiology 1974 Jul-Aug 25(7): 433-40
18. Little AG, Golomb HM, Ferguson MK, Skosey C, Skinner DB. Malignant superior vena cava obstruction reconsidered: the role of diagnositic surgical intervention. Ann Thorac Surg 1985 Sep; 40(3): 285-8
19. Geller W. The mandate for chemotherapeutic decompression in superior vena caval of struction. Radiology 1963 Sep; 81(3): 385-7
20. Levitt SH, Jones TK Jr, Kilpatrick SJ Jr, Bogardus CR Jr. Treatment of malignant superior vena caval obstruction. A randomized study. Cancer 1969 Sep; 24(3): 447-51