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A study on role of Preoperative embolisation in surgery of Juvenile Nasopharyngeal Angiofibroma and its outcome

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Abstract:

Introduction- Vascular tumors are tumors arising from blood vessels.Vascular tumors in ear nose and throat are rare but not uncommon. Tumor embolisation is defined as the blockage of the vascular supply to a tumor. The blockage is usually performed through an endovascular approach but may also be performed by Direct Percutanous injection of embolic agent into the tumour. There are many advantages of pre surgical embolisation. With this background, the present study was conducted to evaluate the role of Preoperative embolisation in surgery of Juvenile Nasopharyngeal Angiofibroma cases attending a tertiary care hospital of Raipur city (C.G.), India. **Materials and Methods-** The present case control study was conducted in the department of E.N.T. and department of Radiodiagnosis , Dr. B.R.A.M. Hospital, Pt. J.N.M. Medical College, Raipur (C.G.) India during study period November 2013 to October 2014. The cases of JNA then were categorised into stage according to FISCH classification**.** Embolisation was then carried out by superselective cathetarisation or Percutaneous method by interventional radiologist. Data was compiled in MS excel and checked for its completeness, correctness and then it was analyzed**. Results-** Mean age of study subjects was 14.5yr with S.D. $\pm$ 0.940. Embolised cases consume less intraoperative time as compared to non embolised cases. Embolised cases had less postoperative stay than non embolised cases which was extending to 3 weeks. **Conclusion-** In this study we conclude that Presurgical endovascular embolisation has definite role in the management of juvenile nasopharyngeal angiofibroma.

Key words: Embolisation, Cathetarisation, Vascular Tumor, Juvenile Nasopharyngeal Angiofibroma, Digital Substraction Angiography

Introduction:

Vascular tumors are tumors arising from blood vessels.Vascular tumors in ear nose and throat are rare but not uncommon. Among the most frequently encountered in Ear ,Nose and Throat department are Hemangiomas which are mostly seen in infantile and childhood stage(>10% of cases)**[1]**.Second most common vascular tumor which is seen in E.N.T department is Juvenile Nasopharyngeal Angiofibroma which is benign in nature but locally malignant (may displace adjacent structures and erode bone).These are mostly seen in ages between 14 and 23 and thought to be Testosterone dependent **.**

As these tumors arise from blood vessel, therefore embolisation of vascular tumors has become an important adjunct to the surgical treatment of these tumors.Tumor embolisation is defined as the blockage of the vascular supply to a tumor. The blockage is usually performed through an endovascular approach but may also be performed by Direct Percutanous injection of embolic agent into the tumour. **[2].** The procedure is usually performed in a single session, simultaneously with Diagnostic Arteriography, but may also be performed in multiple staged sessions.

Ideally, an embolic agent is chosen that will block the very small vessels within the tumor but spare the adjacent normal tissue. Liquid embolic agents, such as Ethanol or Acrylic, and powdered particulate materials can penetrate into the smallest blood vessels of the tumor but need to be used very selectively because they can also cause the most damage to adjacent normal tissues. Relatively large particulate agents, such as Polyvinyl alcohol and Gelfoam, do not penetrate into the tumor as deeply but are also less likely to damage adjacent normal tissues. Embolic agents may be permanent or

temporary. The complication of endovascular embolization could be unexpected cranial nerve palsy, which prompts the procedure to be done by expert interventional radiologist **[3].**

There is a great variability in the location of tumors with some tumors being easier to remove and others being more difficult. There is also variability in the expertise of the surgeon in dealing with various tumor. The pre requisite to preoperative tumor embolization is vascular mass. There are many advantages of pre surgical embolisation. In last decade pre surgical embolisation has become prime adjunct for removal of these vascular tumors. Selecting the patient suspected of having vascular tumors and diagnosing them on basis of clinical, radiological and DSA (Digital Substraction Angiography), embolising the tumor by using embolic agents and then operating the tumor within 72 hrs (to have maximum effect of embolisation),this protocol if properly followed has great outcome in removing these vascular tumors with a minimum or no recurrence. With this background, the present study was conducted to evaluate the role of Preoperative embolisation in surgery of Juvenile Nasopharyngeal Angiofibroma cases attending a tertiary care hospital of Raipur city (C.G.), India.

Materials and Methods

The present study was conducted in the department of E.N.T. and department of Radiodiagnosis, Dr. B.R.A.M. Hospital, Pt. J.N.M. Medical College, Raipur (C.G.) India during study period November 2013 to October 2014. The patient coming in OPD (out patient department) or emergency having suspected vascular tumor was evaluated for evidential proof of vascular tumors (i.e CT, MRI, Catheter angiogram). Informed consent regarding the risks of procedure was taken prior to each procedure.

If having vascular tumors they were recruited as cases. This study was a case control study, the cases were those who after clinical and radiological diagnosis were diagnosed as having vascular tumors.The cases of JNA then were categorised into stage according to **FISCH** classification **[4].**

Staging	**Spread of tumor**
I	Tumor limited to Nasal cavity, Nasopharynx with no bony destruction.
II	Tumor invading Pterygomaxillary fossa,Paranasal sinuses with bony destruction.
III	Tumor invading Infratemporal fossa,Orbit and/or Parasellar region remaining lateral to Cavernous sinus.
IV	Tumor invading Cavernous Sinus,Optic Chiasmal reigon or Pituitary fossa.

These cases underwent preliminary ENT check up (i.e Nasal endoscopy, Telelaryngoscopy, Examination under Microscopy, Pure tone audiogram etc.) The controls were those having same clinical presentation as cases and radiologically same staging/diagnosis as cases. Getting pre anaesthetic check up before undergoing embolisation and surgery. Patient then underwent pre surgical embolisation in DSA (Digital Substraction Angiography) unit of radiodiagnosis department to see the arterial feeders- and angioarchitecture of the tumour. Embolisation was then carried out by superselective cathetarisation or Percutaneous method by interventional radiologist.

For embolisation PVA particles (Polyvinyl alcohol foam)of size (300-500 micrometer), GLUE (n-butyle-2-cyanoacrylate), microcoil were used. Within 72 hrs he/she then underwent surgery to have maximum effect of embolisation. The intraoperative blood loss was calculated by blood drenched in gauge packs (1 medium size wet gauge after squeezing=20gm, fully drenching with blood its weight becomes 50gm so the avg blood soaked by medium sized gauge is 30 ml. similarly one large wet gauge after squeezing weighs=100gm, fully drenching with blood it weighs=300gm, i.e around 200ml of blood is soaked by one large wet gauge.) and the blood collected in suction machine.

Its intraoperative blood loss was compared with the blood loss of controls (who were patients having vascular tumour and were operated without aid of pre surgical embolisation, having same stage in case of JNA. The intraoperative time taken, postoperative hospital stay was compared and documented. The intraoperative and postoperative blood transfusion were also compared and documented.

Data was compiled in MS excel and checked for its completeness, correctness and then it was analyzed**.**

Results

Table 1: Age wise distribution of cases

	Range	Mini.	Max.	Mean	S.E.	S.D.
Age in years	3.0	13.0	16.0	14.5	.251	.941

Mean age of study subjects was 14.5yr with S.D. ± 0.941. All the subjects were male.

Table 2: Comparision Between Blood Loss Of Embolised Cases With Blood Loss Of Non Embolised Cases During Their Excision

Cases With Embolisation Along With Staging Of Tumor(JNA)		Blood Loss In Millilitres	Cases Without Embolisation Along With Staging Of Tumor(JNA)		Blood Loss In Millilitres
Case 1	StageIII	1500ml	Case1	StageIII	2500ml
Case2	StageIII	1500ml	Case2	StageIII	3000ml
Case3	StageII	1000ml	Case3	StageII	1800ml
Case4	StageIII	1200ml	Case4	StageIII	2000ml
Case5	StageII	1000ml	Case5	StageII	2000ml
Case6	StageIII	2000ml	Case6	StageIII	2000ml
Case7	StageII	1200ml	Case7	StageII	1500ml
Case8	StageIII	1500ml	Case8	StageIII	3000ml
Case9	StageII	800ml	Case9	StageII	2000ml
Case10	StageIII	2000ml	Case10	StageIII	2300ml
Case11	StageII	800ml	Case11	StageII	1500ml
Case12	StageII	1000ml	Case12	StageII	1500ml
Case13	StageIII	1500ml	Case13	StageIII	2500ml
Case14	StageII	500ml	Case14	StageII	700ml

Mean Blood Loss Of Embolised Cases(StageII)=900ml
Mean Blood Loss Of Embolised Cases (StageIII)=1600ml
Mean Blood Loss Of Non Embolised Cases(StageII)=1571ml
Mean Blood Loss Of Non Embolised Cases(StageIII)=2471ml

Except one case(i.e case 6 had same blood loss as his counterpart), rest all embolised cases had less blood loss when compared with controls.JNA as one knows bleeds heavily intraoperatively,sometimes(as looking through the data)could proceed to more than shock(>40% of total blood volume) which could result sometimes death on operation table. **(Table-II)**

Table 3: Comparision Between Time Consumed For Surgery Of Embolised And Non Embolised Cases

Embolised Cases Along With Staging(JNA)		**Time Consumed For Surgerys**	**Non Embolised Cases Along With Staging(JNA)**		**Time Consumed For Surgery**
Case1	StageIII	150 Minutes	Case1	StageIII	225 Minutes
Case2	StageIII	180 Minutes	Case2	StageIII	235 Minutes
Case3	StageII	90minutes	Case3	StageII	165 Minutes
Case4	StageIII	150minutes	Case4	StageIII	180 Minutes
Case5	StageII	120 Minutes	Case5	StageII	180 Minutes
Case6	StageIII	180 Minutes	Case6	StageIII	240 Minutes
Case7	StageII	150 Minutes	Case7	StageII	155 Minutes
Case8	StageIII	150 Minutes	Case8	StageIII	195 Minutes
Case9	StageII	150 Minutes	Case9	StageII	120 Minutes
Case10	StageIII	180 Minutes	Case10	StageIII	200 Minutes
Case11	StageII	150 Minutes	Case11	StageII	165 Minutes
Case12	StageII	150 Minutes	Case12	StageII	155 Minutes
Case13	StageIII	180 Minutes	Case13	StageIII	240 Minutes
Case14	StageII	120 Minutes	Case14	StageII	180 Minutes
1.Mean Time Consumed For StageII(Embolised)=133 Minutes 2. Mean Time Consumed For StageIII(Embolised)=167 Minutes, 3.Mean Time Consumed For StageII(Non Embolised)=146 Minutes 4.Mean Time Consumed For StageIII(Non Embolised)=216 Minutes					

Embolised cases consumed less intraoperative time as compared to non embolised cases. **(Table-III)**

Table 4: Comparision Between Post Operative Hospital Stay Of Embolised And Non Embolised Cases

Embolised Cases Along With Their Staging(JNA)		**Postoperative Hospital Stay In Days**	**Non Embolised Cases Along With Their Staging(JNA)**		**Postoperative Hospital Stay In Days**
Case1	StageIII	14 Days	Case1	StageIII	21days
Case2	StageIII	18 Days	Case2	StageIII	21days
Case3	StageII	9 Days	Case3	StageII	17days
Case4	StageIII	14 Days	Case4	StageIII	15days
Case5	StageII	10 Days	Case5	StageII	21 Days
Case6	StageIII	21 Days	Case6	StageIII	21days
Case7	StageII	14 Days	Case7	StageII	16days
Case8	StageIII	14days	Case8	StageIII	21 Days
Case9	StageII	7 Days	Case9	StageII	18 Days
Case10	StageIII	18 Days	Case10	StageIII	21days
Case11	StageII	10 Days	Case11	StageII	21days
Case12	StageII	14 Days	Case12	StageII	16days
Case13	StageIII	14days	Case13	StageIII	21days
Case14	StageII	10 Days	Case14	StageII	10 Days
Mean Postoperative Hospital Stay Of Embolised Cases StageII=10 Days Mean Postoperative Hospital Stay Of Embolised Cases StageIII=16 Days Mean Postoperative Hospital Stay Of Non Embolised Cases StageII=17 Days Mean Postoperative Hospital Stay Of Non Embolised Cases StageIII=20 Days					

Embolised cases have less postoperative stay than non embolised cases which are extending to 3 weeks.Only two cases i.e case6 and case10 have same postoperative stay as its control. **(Table-IV)**

Table 5: Comparision Between Blood Transfused Intraoperatively And Postoperatively In Embolised And Nonembolised Cases

Embolised Cases Of JNA Along With Their Staging		**Blood Transfused Intraoperatively And Postoperatively**	**Non Embolised Cases Of JNA Along With Their Staging**		**Blood Transfused Intraoperatively And Postoperatively**
Case1	StageIII	4units	Case1	StageIII	8units
Case2	StageIII	5units	Case2	StageIII	10units
Case3	StageII	3units	Case3	StageII	6units
Case4	StageIII	4units	Case4	StageIII	7units
Case5	StageII	3units	Case5	StageII	7units
Case6	StageIII	6units	Case6	StageIII	10units
Case7	StageII	4units	Case7	StageII	5units
Case8	StageIII	5units	Case8	StageIII	8units
Case9	StageII	2units	Case9	StageII	2units
Case10	StageIII	6units	Case10	StageIII	8units
Case11	StageII	2units	Case11	StageII	7units
Case12	StageII	3units	Case12	StageII	5units
Case13	StageIII	4units	Case13	StageIII	9units
Case14	StageII	1unit	Case14	StageII	5units
Mean Blood Transfused To Embolised Cases(StageII)=2units Mean Blood Transfused To Embolised Cases(StageIII)=5units Mean Blood Transfused To Non Embolised Cases(StageII)=5units Mean Blood Transfused To Non Embolised Cases(StageIII)=8units					

Embolised cases have less blood transfused intraoperatively and postoperatively as compared to non embolised cases.(Except 1 case,i.e case no 9) **(Table-V)**

Discussion

Angiography and intra-arterial embolization of a tumor contributes in diagnosis, surgical planning, and treatment. Characterization of angiographic features including vascular architecture and flow patterns can contribute to diagnosis. Angiography also provides intricate evaluation of the tumor vascular supply and proximity of neighboring vessels that can be of great value in surgical planning. Intra-arterial embolization is often adjunctive therapy prior to surgical resection. Embolization and devascularization of these tumors can reduce blood loss during surgical resection and improve visualization of the surgical site. In patients who are not candidates for surgical resection, intra-arterial embolization can provide palliative therapy. The advent of targeted therapies such as anti-bodies, nanoparticles, and gene vectors may herald a new era of intra-arterial delivery of therapeutic agents to these tumors.

The unique characteristics of each embolic material offer several options for tumor devascularization. Commonly used embolization materials include poly vinyl alcohol (PVA) particles of varying sizes as well as pledgets of gelatin sponge (Gelfoam, Pfizer, New York, NY, USA) and microfibrillar collagen. Liquid embolization agents include, n-butylcyanoacrylate (nBCA; Trufill nBCA Liquid Embolic, Codman Neurovascular Inc., Raynham, MA, USA), ethyl vinyl alcohol polymer (Onyx, eV3 Endovascular Inc., Irvine, CA, USA), and ethanol. Occlusion of large vessels may require use of either pushable or detachable coils.

Complications from endovascular embolization include unintended occlusion from embolic material that can result from reflux of liquid embolic material and small particle size. Temporary balloon occlusion can be used as a technique to control placement of embolic material. Particle size must be chosen appropriately to allow for controlled delivery and catheter placement must be distal to origins of vessels to be preserved.

Patients suspected of having vascular tumor were first clinically evaluated in OPD/ emergency,

anterior and posterior rhinoscopy done to see clinically the extention of Juvenile Nasopharyngeal Angiofibroma.

A routine tuning fork test was done in each of the case to assess the hearing of the individual,after TFT individual was sent for pure tone audiometry evaluation. This was done to have a record of his/her normal or impaired/reduced hearing.

Most of the cases of JNA came to us in emergency with history of recurrent epistaxis (most of the time unilateral, but sometimes bilateral also) and unilateral nasal obstruction. These cases were given primary treatment (i.e i.v hemostatic, local hemostatics, i.v antibiotics) and admitted in ENT ward with provisional diagnosis of vascular tumor.

After admission JNA cases underwent contrast CT PNS and MRI. After this we send patient to Anaesthesia department for pre anaesthetic evaluation before any procedure (i.e contrast angiography, embolisation, surgery).

The Cases then went for DSA(digital substraction angiography) to look for the feeders of the vascular tumor. Having idea of the feeders and their supplying artery, they were selectively embolised by embolising material in same setting. Embolising material GLUE, PVA and MICROCOIL were used for cases of JNA. These cases were embolised in DSA (digital substraction angiography) unit in department of radiodiagnosis. The procedure was done by interventional radiologist and his team. Serial ANGIOGRAPHY slides were prepared to have record of each procedured patient.

One patient had feeders from internal carotid also, postoperatively this patient developed pseudoaneurysm in one of the branches of ICA and presented with epistaxis when nasal pack was being removed. Immediate endovascular coiling of the pseudoaneurysm was performed to control bleeding. Currently he is in regular follow up with the interventional radiologist/ENT department and there is no recurrence of pseudoaneurysm.The intraoperative blood loss during surgery was almost same as their control.A finding consistent with study done by Petrusen K,Rodriguez-Catarino M,Petrusen B et al **[5].**

All the patients were successfully embolised.Patients after embolisation were kept in ICU and were operated within 72 hrs to have the maximum effect of embolisation. The radiological evaluation regarding the extent of tumour and his/her angiographic slides helped us in planning the surgery.

All of the cases of JNA were male and were in the age group of 10-20.

Mean blood loss for the embolised cases stageII was 900ml which was far less when compared to non embolised cases of stageII (which was 1571ml).A significant difference of 671ml,which shows the advantage of presurgical embolisation.

Similarly embolised cases of JNA stageIII had mean blood loss of 1600ml and their counterparts had mean blood loss of 2471ml,another significant difference of 871ml.These findings were consistent with findings of Garcia-Cervigon E,Bien S,Riifenacht D,Thurel C,Reizine D,Huy PTB,Merland JJ. **[6]** and Moulin G,Chagnaud Ch,Gras R et al **[7] ($p<0.05$).**

When intraoperative time were noticed between the two, it was noted that mean intraoperative time for surgical excision of embolised cases of stage II and stage III were 133minutes and 167minutes respectively ,whereas for non embolised cases of stage II and stageIII were 146minutes and 216minutes respectively. A difference of 13 minutes and 49minutes respectively. Which shows that the presurgical embolisation also reduces intraoperative time, a finding consistent with the study done by Roberson GH, Biller H, Sessions DG et al. **[8].**

Also the postoperative hospital stay and intra and postoperative blood transfusion were less in case of embolised cases when compared to non embolised cases suggesting the advantage of presurgical embolisation.

Conclusion:

In this study we conclude that Presurgical endovascular embolisation has definite role in the management of Juvenile Nasopharyngeal Angiofibroma. Preoperative embolisation not only reduces intraoperative blood loss and operative time but also decreases morbidity significantly. The findings of the present study will be useful for surgeons to choose appropriate pre surgical interventions for effective outcome.

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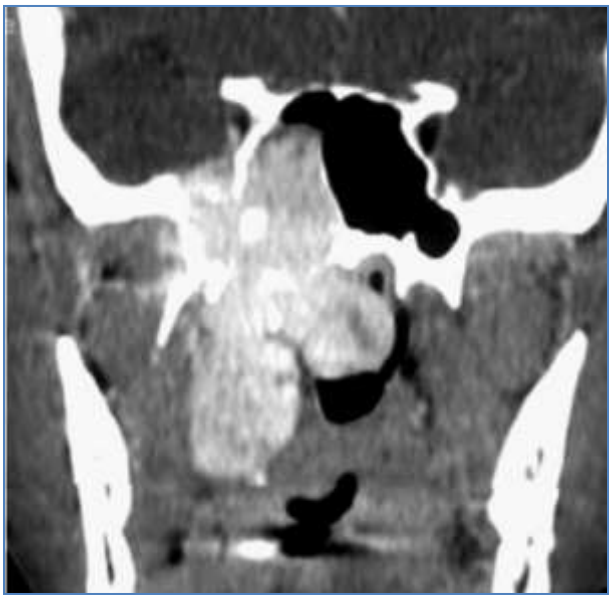


IMAGE 1: Coronal section al CECT PNS of a stage III JNA demonstrating the mass in the Nasopharynx, right nasal cavity, widening of pterygopalatine fossa with extension along the massetric space.

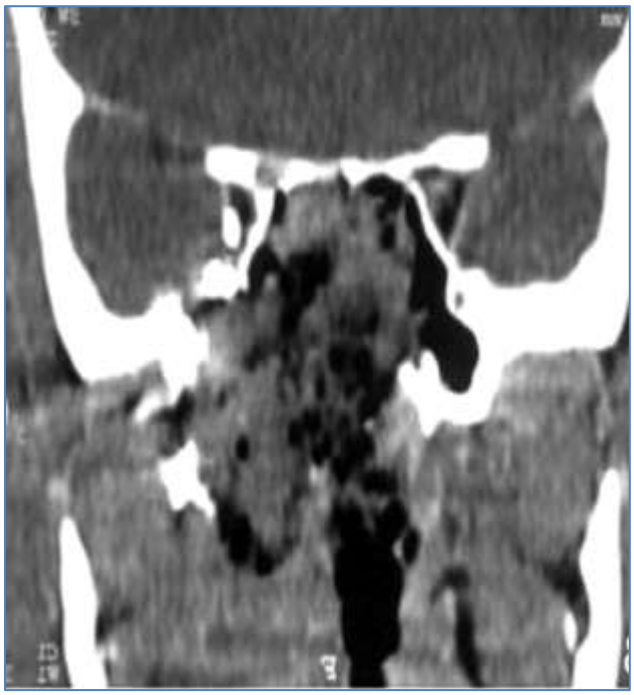


IMAGE 2: Postoperative CECT scan of same patient with tumor excision via Transpalatine Lateral rhinotomy approach.

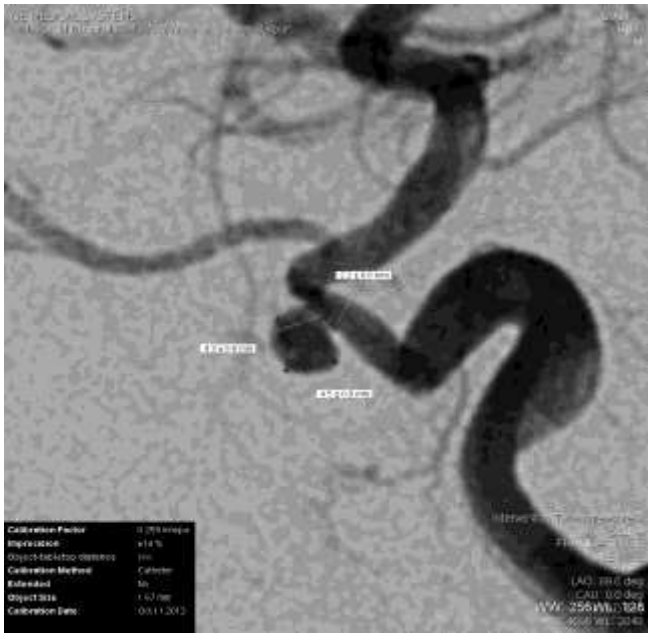
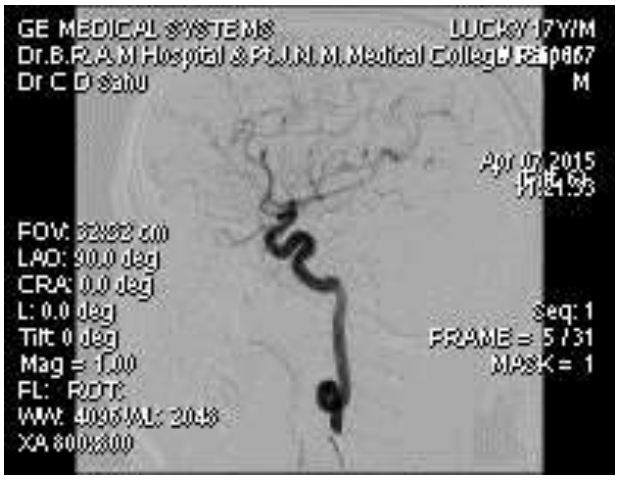


IMAGE 3: Right cavernous ICA Pseudoaneurysm

IMAGE 4. Post coiling



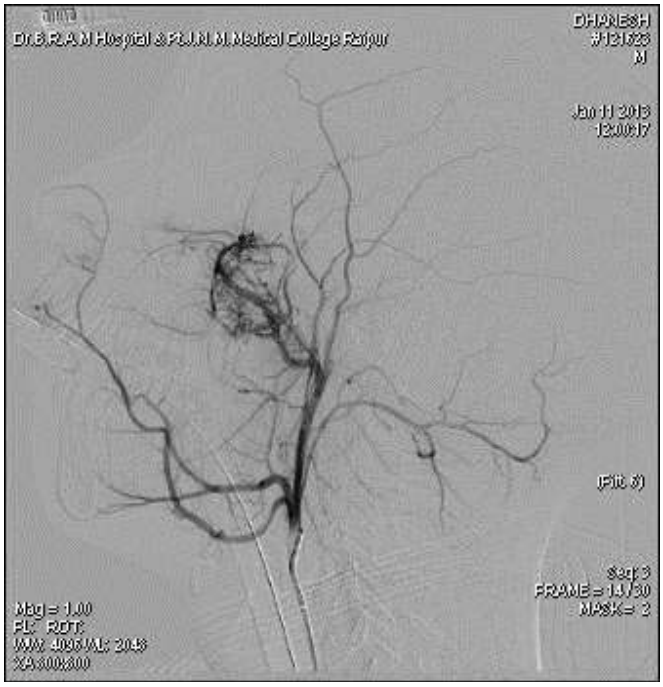


IMAGE-5. Extensive tumor blush with feeders from Internal Maxillary artery.

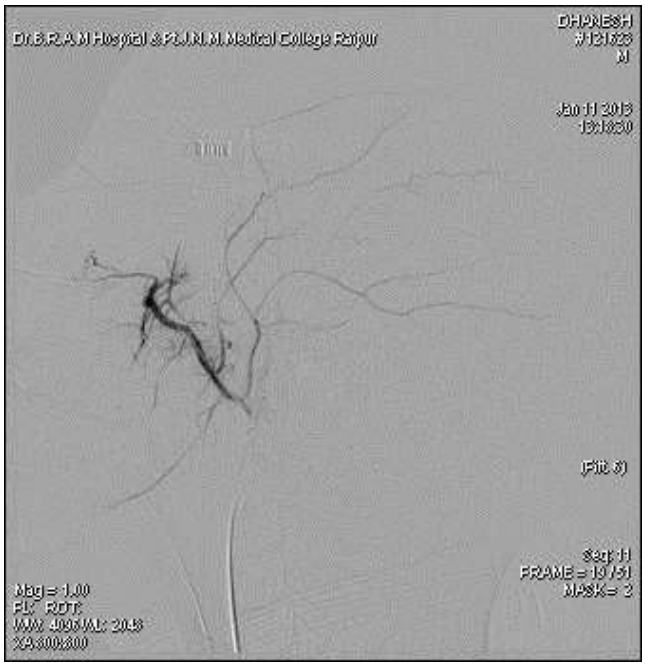


IMAGE-6. Dissapearence of tumor blush after embolisation of same patient.

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