



LA RISONANZA MAGNETICA NELL'ISCHEMIA MIOCARDICA ACUTA

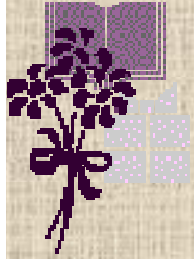
Dott Elisabetta Chiodi

SERVIZIO DI RADIOLOGIA OSPEDALIERA

***DIPARTIMENTO DIAGNOSTICA PER IMMAGINI
E MEDICINA DI LABORATORIO***

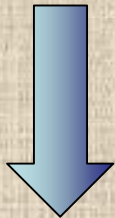
Direttore: dott. Stefano Bigli

Capo Dipartimento: dott. Luciano Feggi



Attività di RM cardiaca:

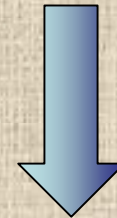
- iniziata gennaio 2008***
- 2 giorni settimanali di attività***
- 2 medici e 5 tecnici***



***PROGETTO MIOT
(STUDIO TALASSEMIA)***



ASSISTENZA



INFARTO ACUTO



RM CARDIACA

DIAGNOSTICA DI 2 ° LIVELLO

PAZIENTI COLLABORANTI E MOTIVATI

TEMPO MACCHINA

TEMPO MEDICO E TECNICO

ELEVATI COSTI

..GIUSTIFICAZIONE...



RM CARDIACA

...che cosa studiamo...????

VASI
MEDIASTINICI

MIOCARDIOPATIE

MIOCARDITI

ISCHEMIA
CRONICA
VITALITA'

STUDIO
DEL PERICARDIO

NEOFORMAZIONI

ISCHEMIA
ACUTA

STUDIO
VALVOLARE

VOLUMI
CINETICA

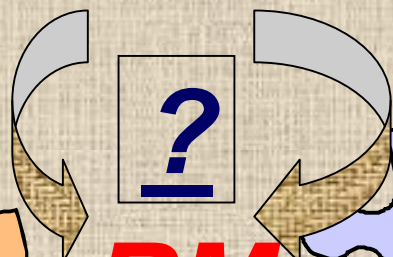
MALATTIE
DA ACCUMULO

CARDIOPATIE
CONGENITE

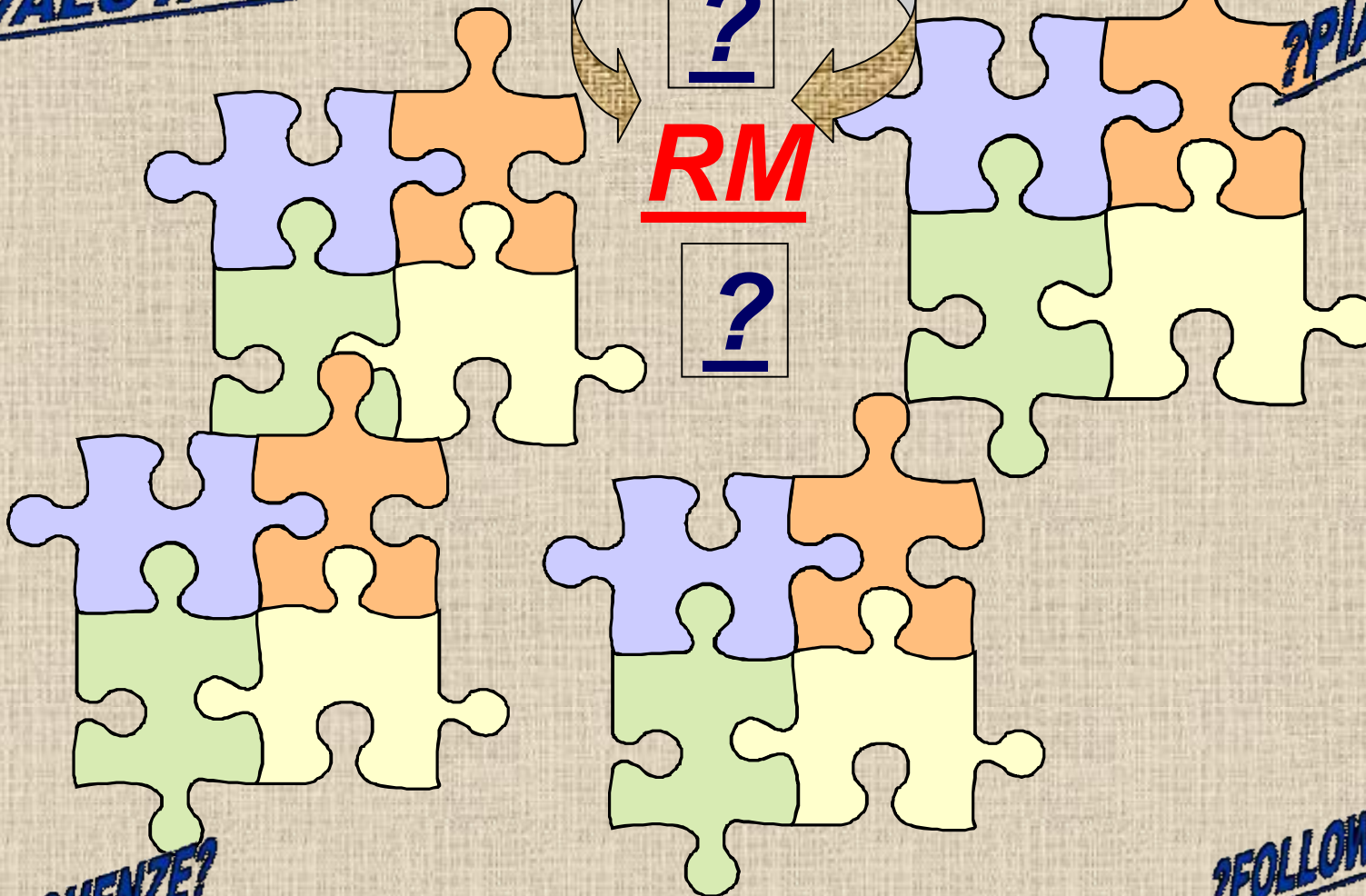
ecc.
ecc...

ISCHEMIA ACUTA

?VALUTAZIONE?



?PIANI?



?SEQUENZE?

?FOLLOW.UP?



ISCHEMIA ACUTA: RM???

- **Non** nella fase diagnostica che viene fatta con la clinica e l' ecg.
- Abbiamo “**ovviamente**” inserito l' RM nella fase acuta post-trattamento di rivascolarizzazione.
- L'RM ci aiuta a capire se alla rivascolarizzazione (apertura del vaso) si associa **riperfusion** efficace del territorio ischemico



LA CASCATA ISCHEMICA





FASE ISCHEMICA ACUTA



Alterazioni della cinetica

Edema intra ed extracellulare

stop

gadolinio

Necrosi parietale

No-reflow

Emorragia

0-25%

25-50%

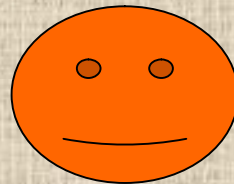
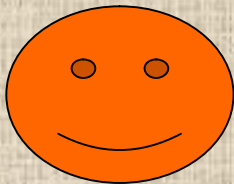
50-75%

75-100%

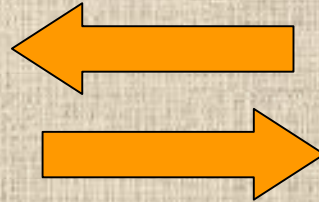


RM ischemia acuta: ?????

- ***Alterazioni della cinetica regionale***
- ***Edema***
- ***Riduzione della perfusione (no reflow)***
- ***Cicatrice***



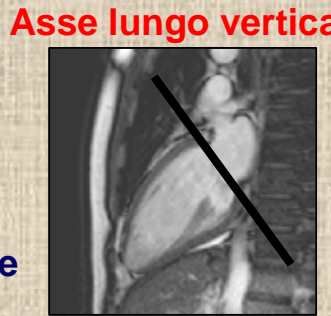
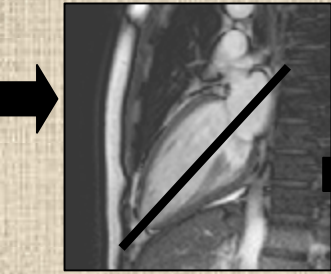
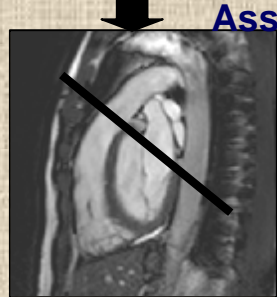
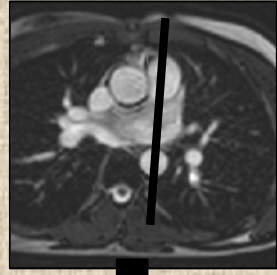
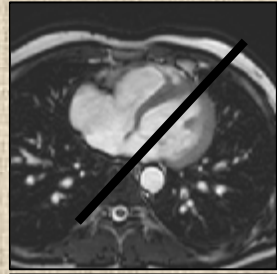
***Modeste discinesie
Poco edema
Perfusione non ridotta
Poca cicatrice***



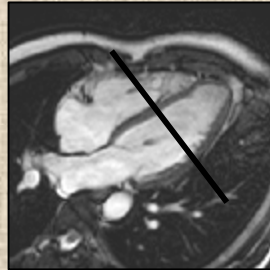
***Marcate discinesia
Molto edema
Ridotta perfusione
Estesa cicatrice***



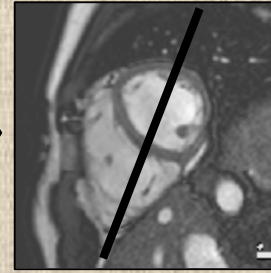
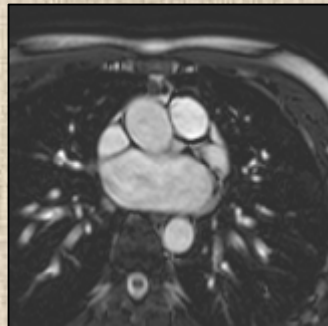
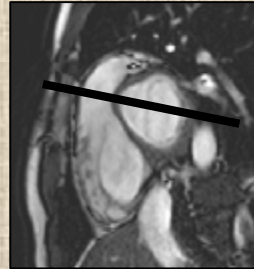
....principali piani in Cardio-RM....



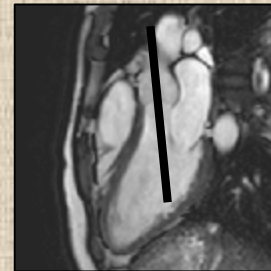
Asse lungo orizzontale



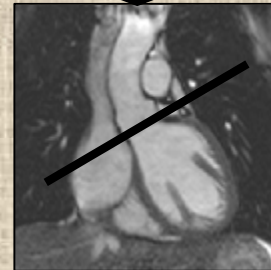
Asse corto basale



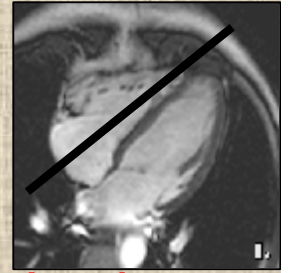
Asse corto



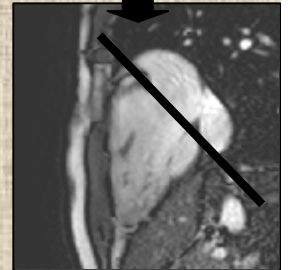
LVOT-OT



LVOT



Asse lungo orizzontale



2 Camere Ventricolo Destro



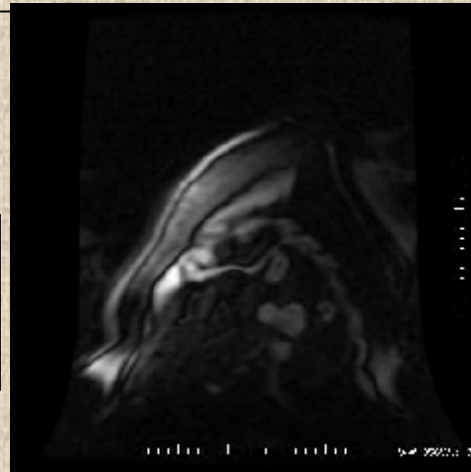


....principali sequenze...



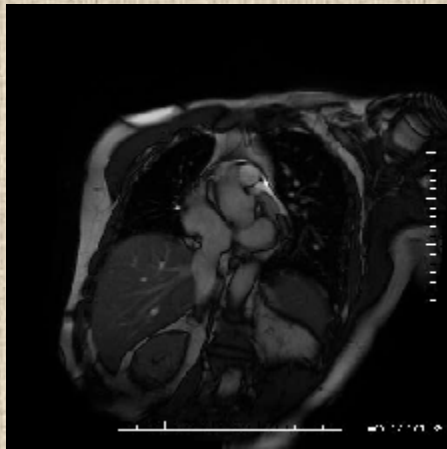
Morfologia
T1w-FSE
SSFP

Perfusione
SPGR/IR spoiled-GE

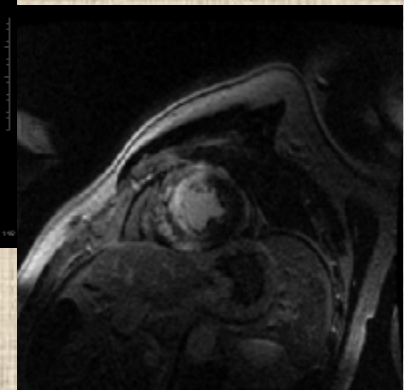
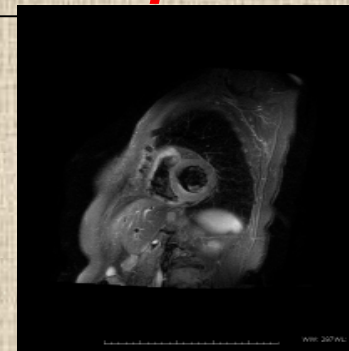


Funzione
b-SSFP cine MRI

Caratterizzazione tissutale
T1w-FSE
T2w-STIR-FSE
DE IR-postrastografiche



Flusso
b-SSFP cine MRI
VENC cine MRI



Arterie Coronarie
b-SSFP



...ISCHEMIA ACUTA..

sequenze precontrastografiche

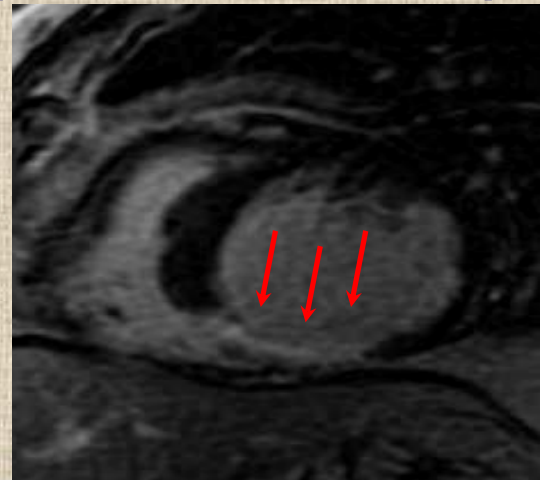
- ➔ **SSFP** (ASSE CORTO 10 mmX 0mm) ➔ **cinetica**
- ➔ **TRIPLE** o **BBT2-fat-sat** ➔ **edema**

➔ sequenze postcontrastografiche

- ➔ **SPGR** DI PERFUSIONE
- ➔ **IRGE** EARLY-DELAYED ENHANCEMENT (TI: 420 msec)
- ➔ **IRGE** LATE-DELAYED ENHANCEMENT (TI:200-300msec)



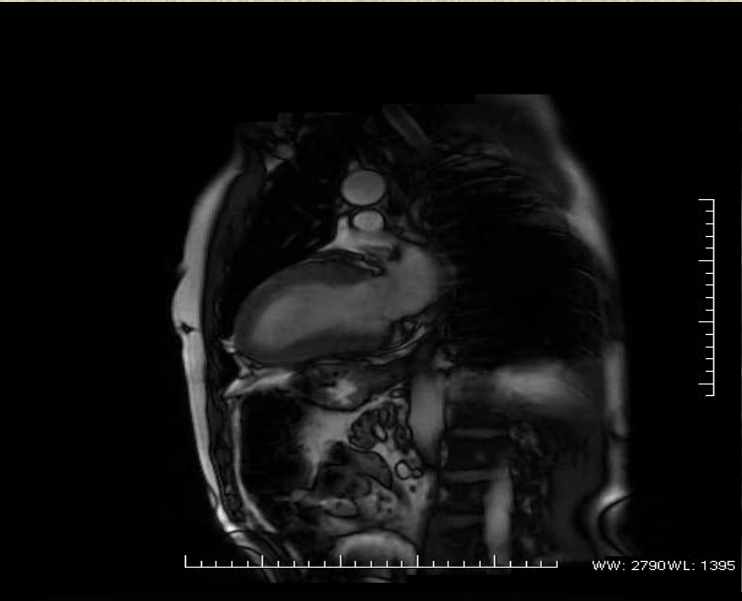
CICATRICE



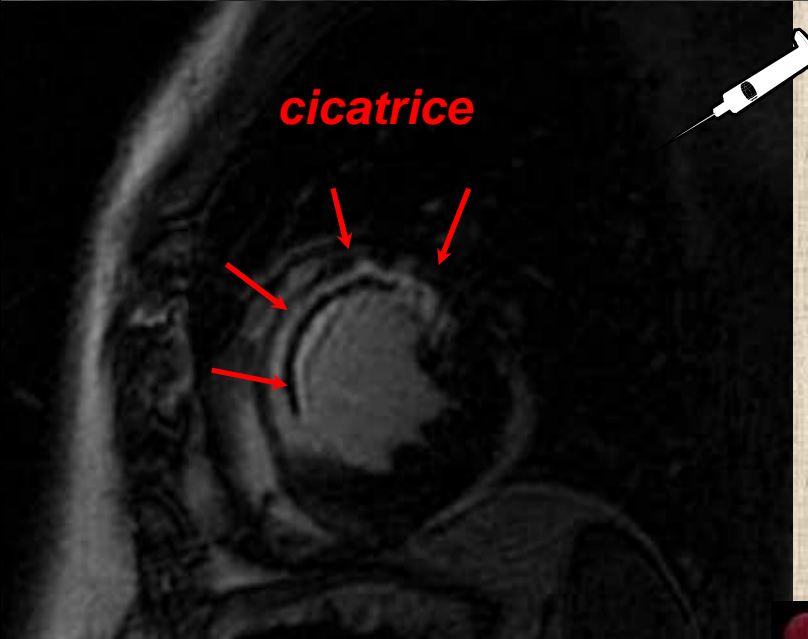
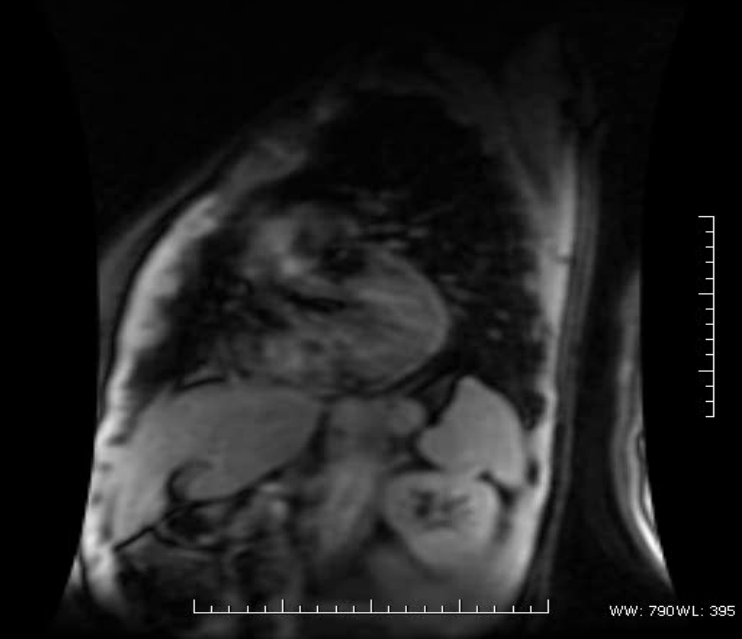
FASE ISCHEMICA ACUTA



acinesia

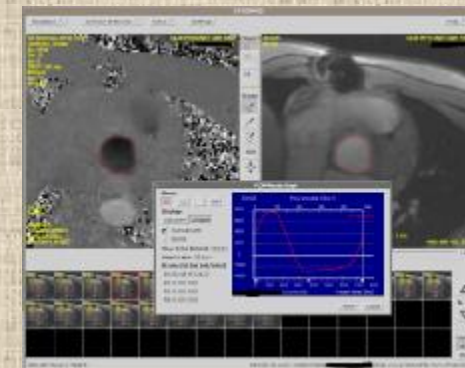
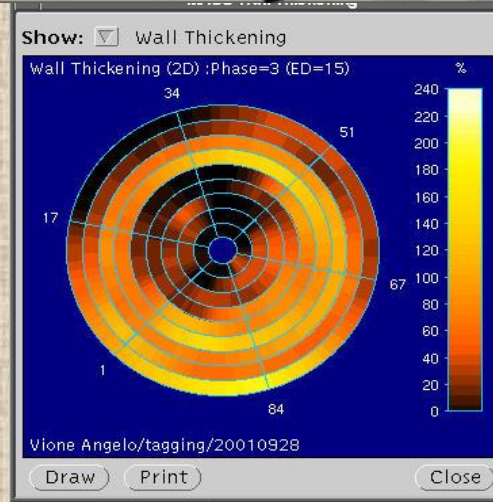
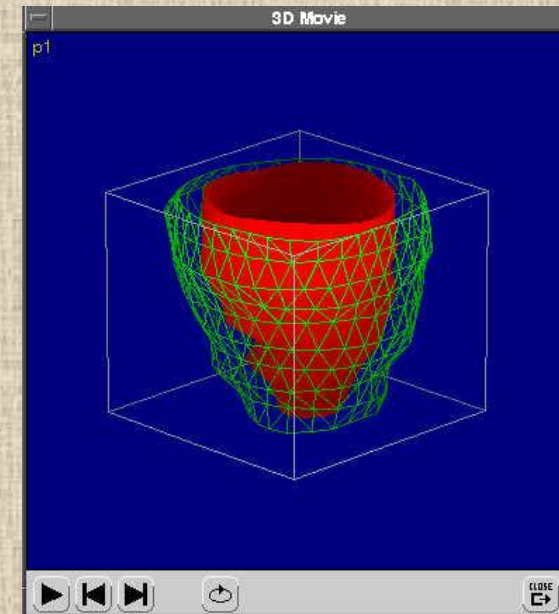
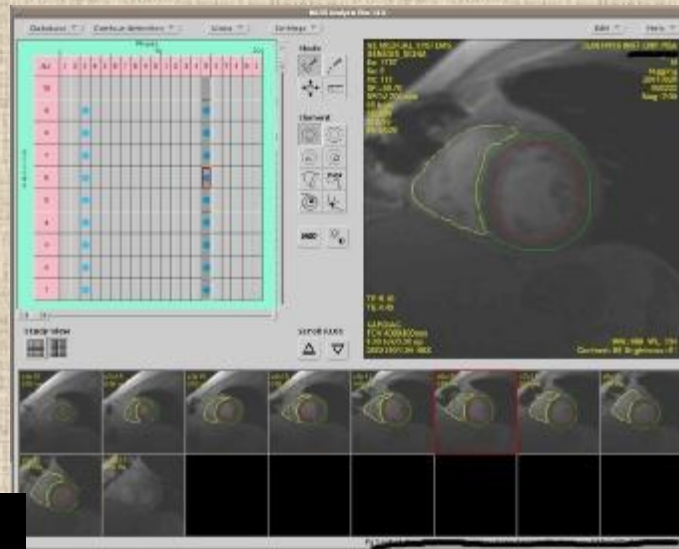
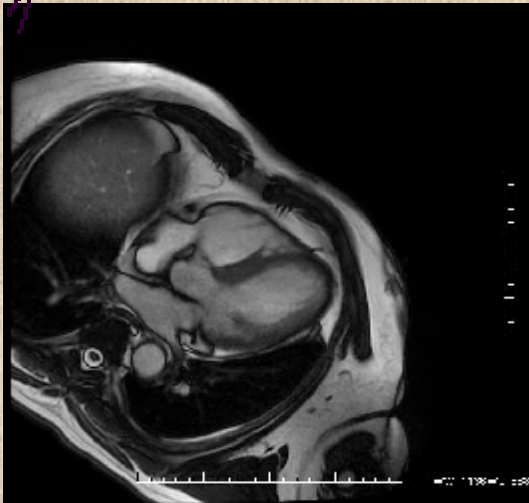
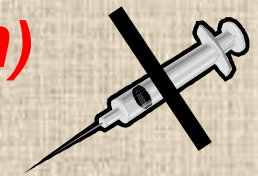


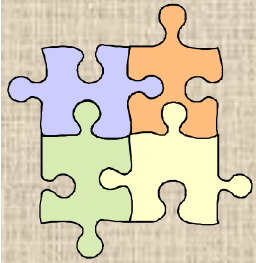
perfusione



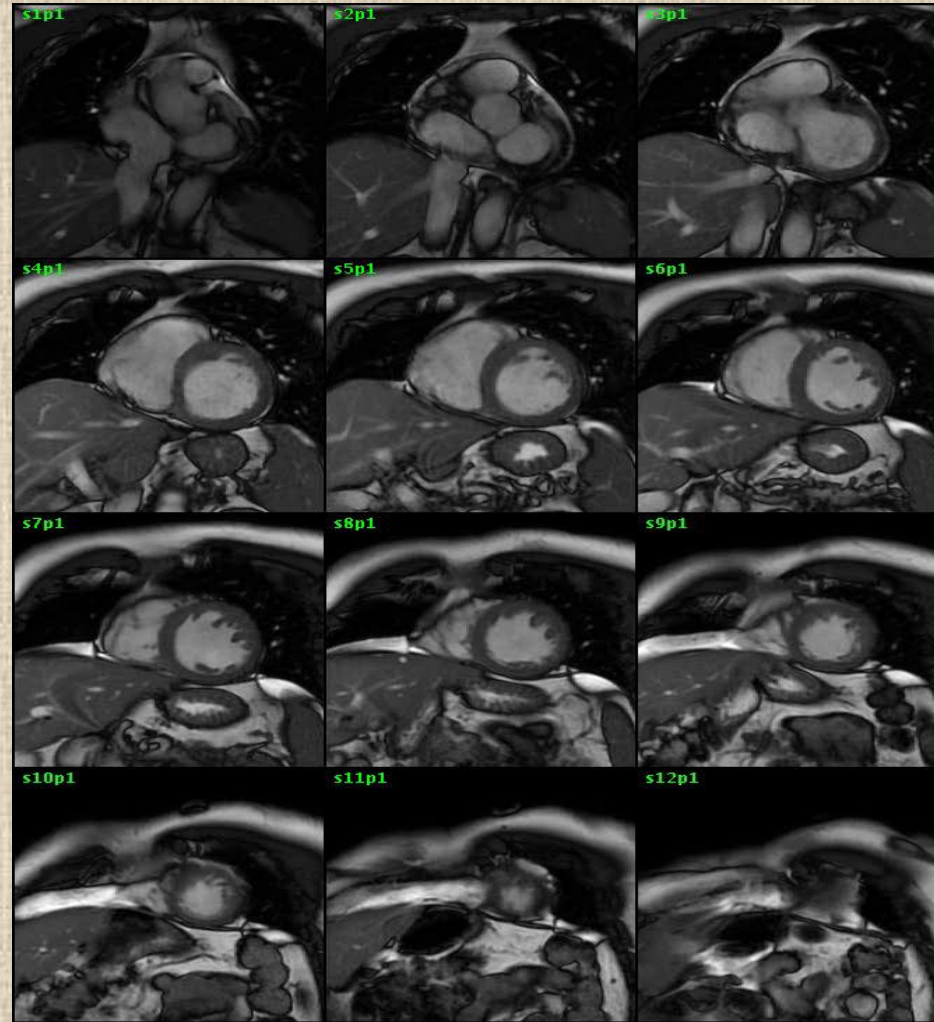
➔ **SSFP (steady state free-precession)**

Post processing





SSFP (steady state free-precession): Valutazione cinetica regionale-globale



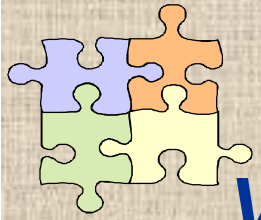
Ospedale S. Anna - Ferrara
 Dip. Diagnostica per Immagini e Med. Laboratorio
 Radiologia Ospedaliera - Direttore Dr. S. Bighi

Data: 20/06/2011
 Ore: 14:30
 Paziente: 44444444

ANCA
 Ventricolo sinistro
 Volume di fine diastole ventricolo sinistro: 119,2 ml
 Volume di fine diastole ventricolo destro: 41,0 ml
 Volume di fine diastole di fine diastole: 115,8 ml
 Volume di fine diastole di fine diastole: 108,0 ml
 Percentuale di riempimento ventricolo sinistro: 45% (36-70)
 Percentuale di fine diastole ventricolo sinistro: 55,3% (50-65)
 Percentuale di fine diastole ventricolo destro: 36,1% (27-47)
 Percentuale di fine diastole ventricolo destro: 37,8%
 Percentuale di fine diastole ventricolo destro: 42,2% (30-45)
 Percentuale di fine diastole ventricolo destro: 57,8%
 Percentuale di fine diastole ventricolo destro: 4,4% (1-10)
 Percentuale di fine diastole ventricolo destro: 2,8% (1-10)
 Percentuale di fine diastole ventricolo destro: 75,1 g

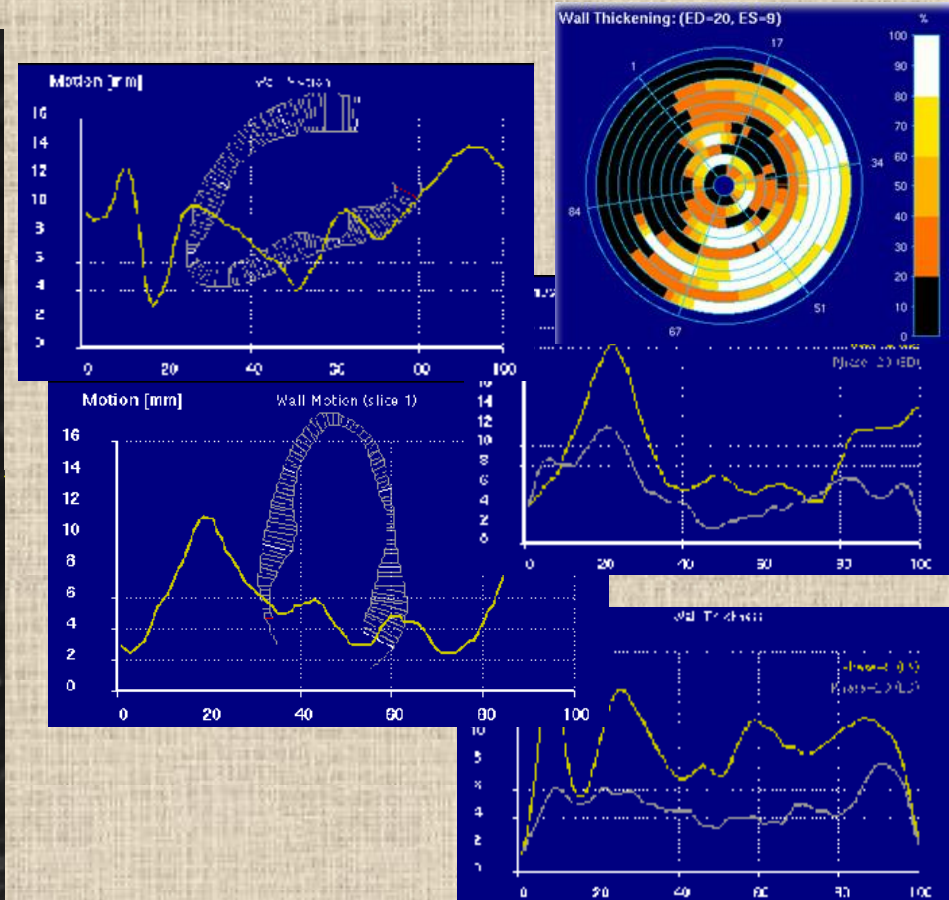
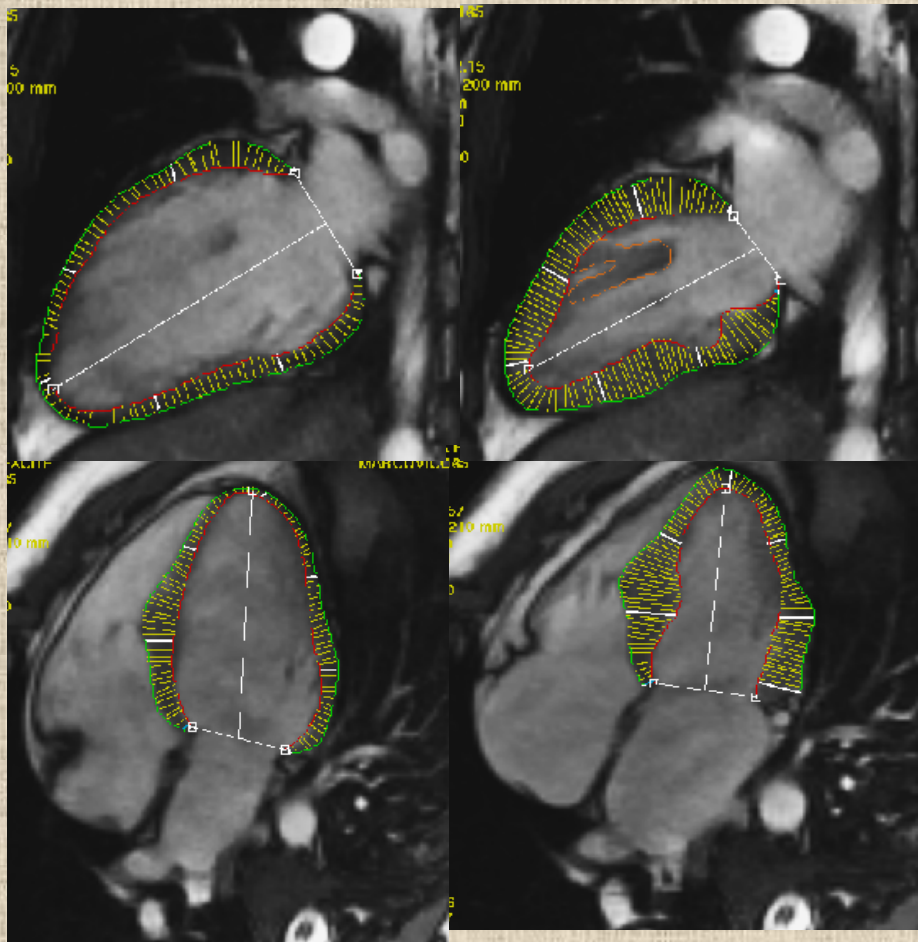
Ventricolo destro
 Volume di fine diastole ventricolo destro: 116,7 ml
 Volume di fine diastole ventricolo destro: 17,1 ml
 Percentuale di riempimento ventricolo destro: 47% (36-70)
 Percentuale di fine diastole ventricolo destro: 75,8%
 Percentuale di fine diastole ventricolo destro: 71,8% (63-80)
 Percentuale di fine diastole ventricolo destro: 19,4% (15-20)

CINETICA FUNZIONE VOLUMI

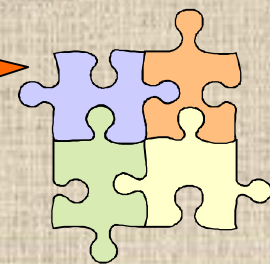


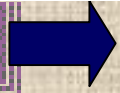
SSFP (steady state free-precession)

Valutazione cinetica regionale parietale



CINETICA PARIETALE:
valutazione quantitativa

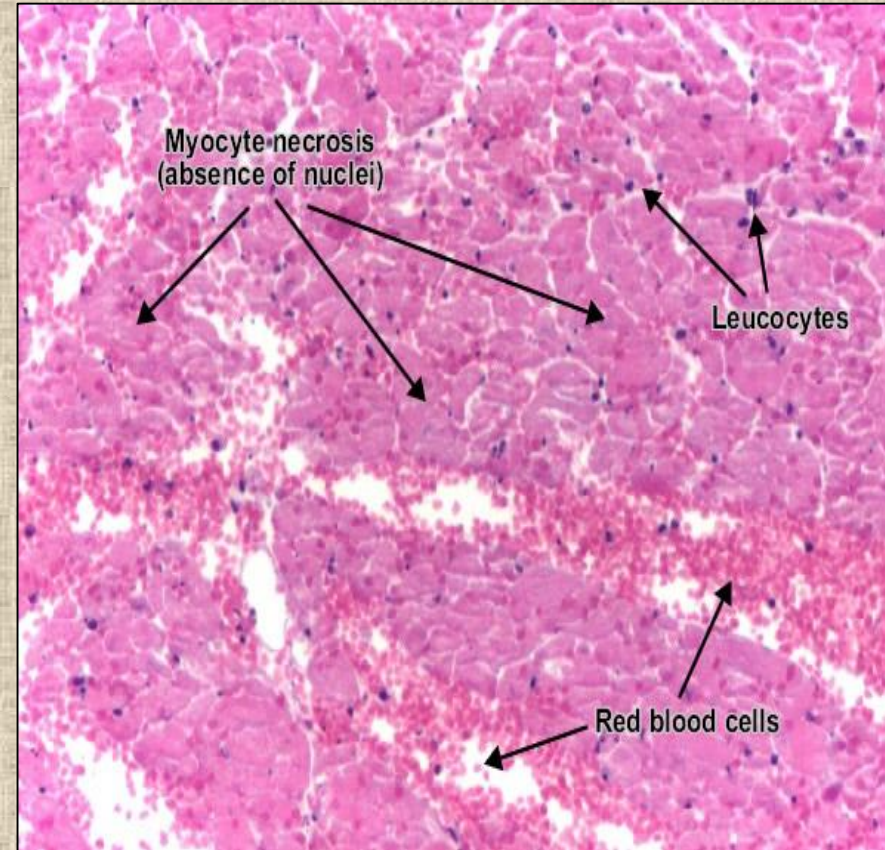


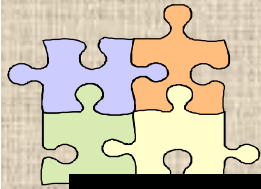


Black-blood T2 FAT-SAT O TRIPLE

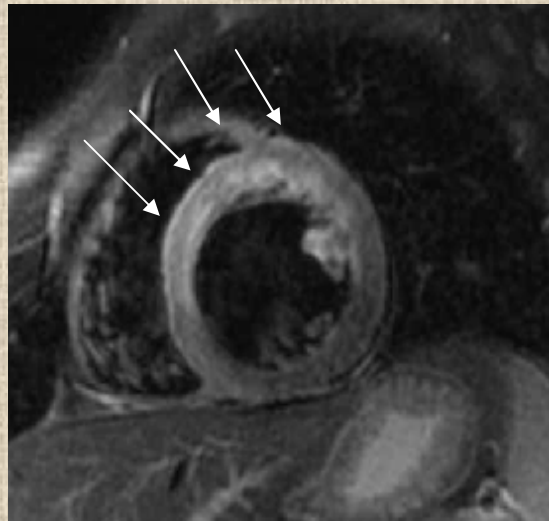
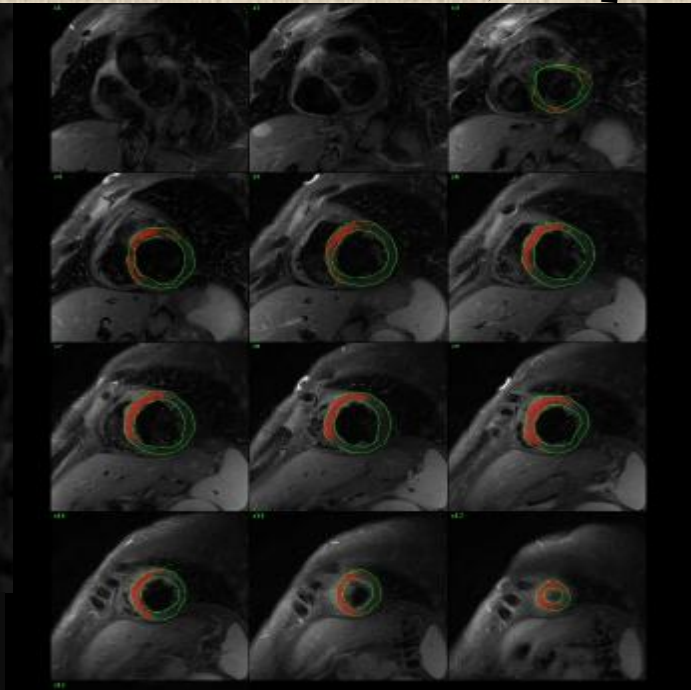
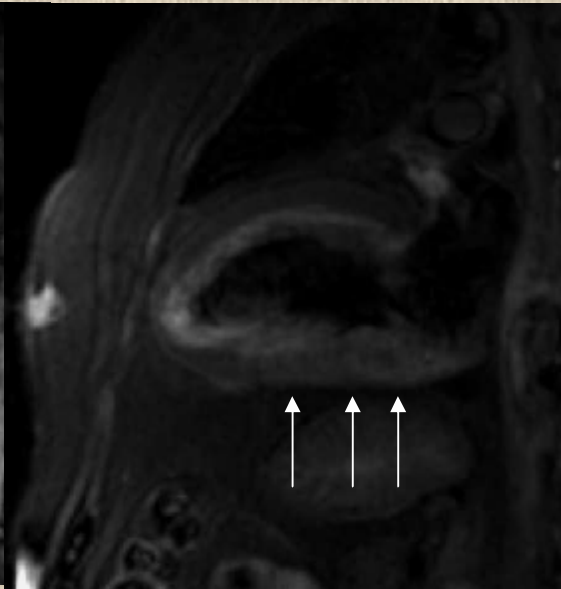
Edema miocardico: meccanismi fisiopatologici

- **Aumento del contenuto intracellulare di acqua**
- **Presenza di sostanze osmoticamente attive nell' interstizio**
- **Distruzione dei meccanismi di trasporto dell'ATP; l' acqua entra nelle regioni ischemiche attraverso i vasi collaterali**
- **Estensione dell' edema nell' interstizio**





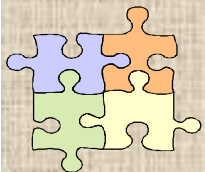
B.Blood T2w-STIR FSE oTRIPLE



**N° DI SEGMENTI
COINVOLTI**
x
**INTERESSAMENTO
PARIETALE**

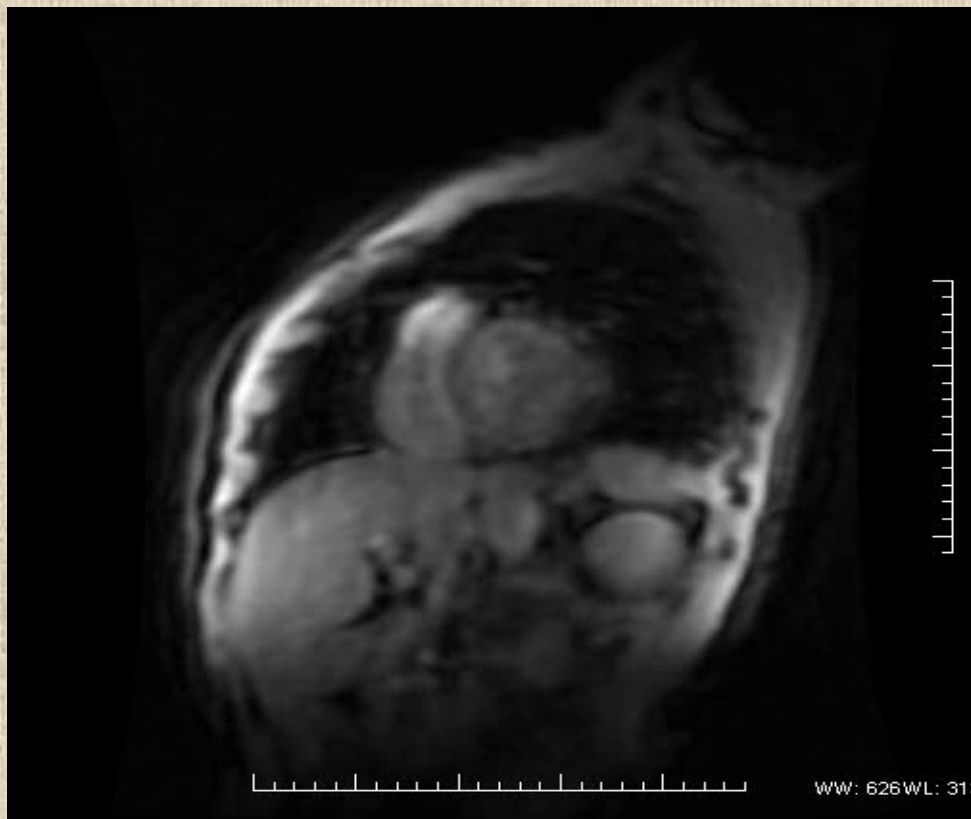
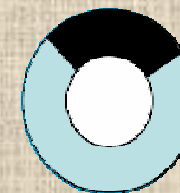
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**EDEMA
VALORE GLOBALE
(gr e % sulla massa)**



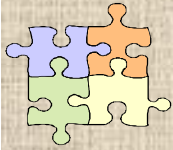
SEQUENZE CONTRASTOGRAFICHE

➔ **SPGR: Spoiler gradient echo di perfusione**



SPGR perfusione:
Difetto di perfusione



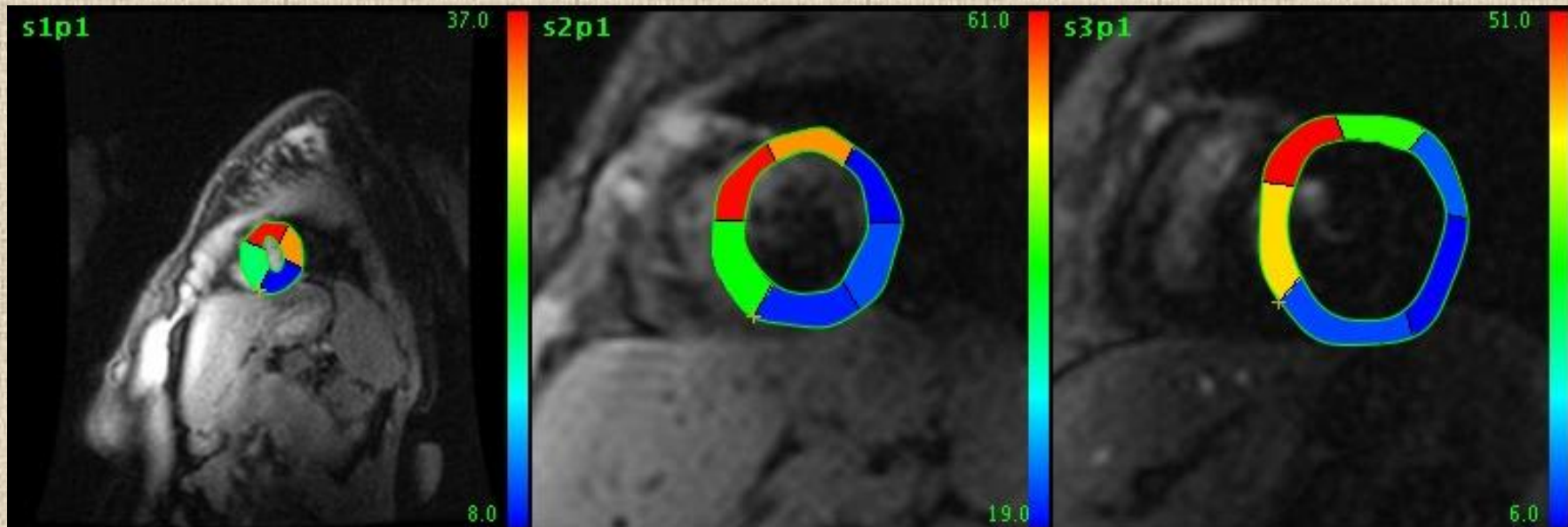


Spoiler gradient echo di perfusione: **SPGR**



perfusione (primo passaggio)

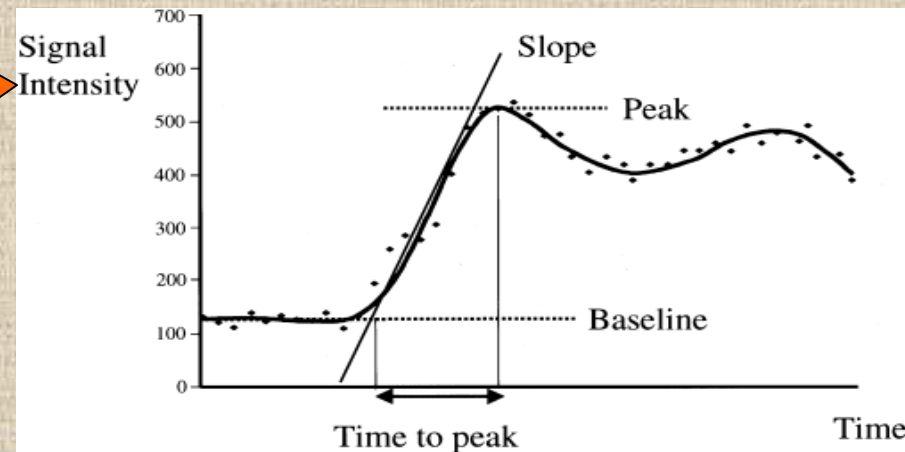
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Valutazione semiquantitativa

soggettiva

perfusione

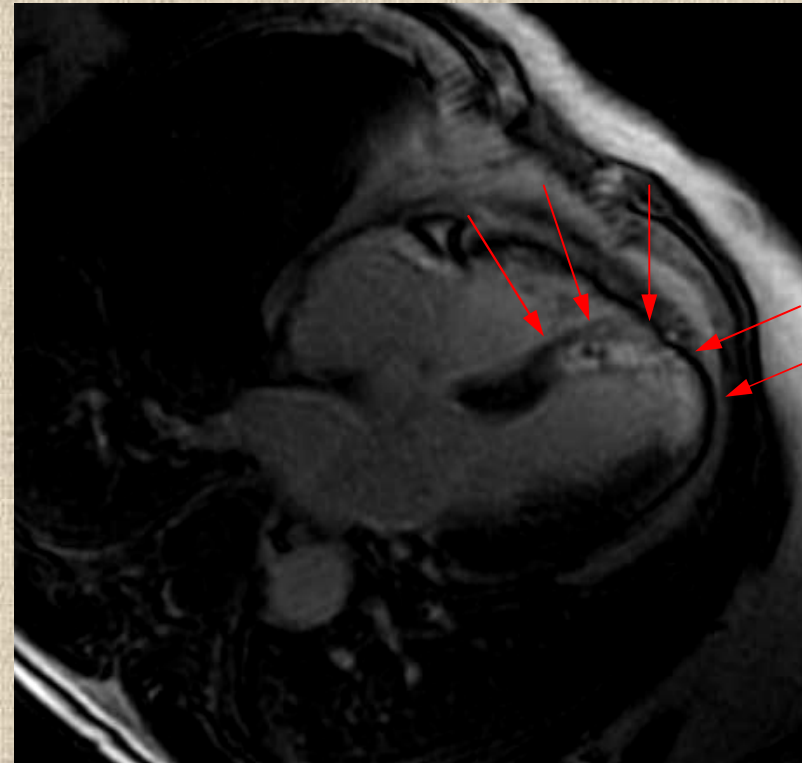
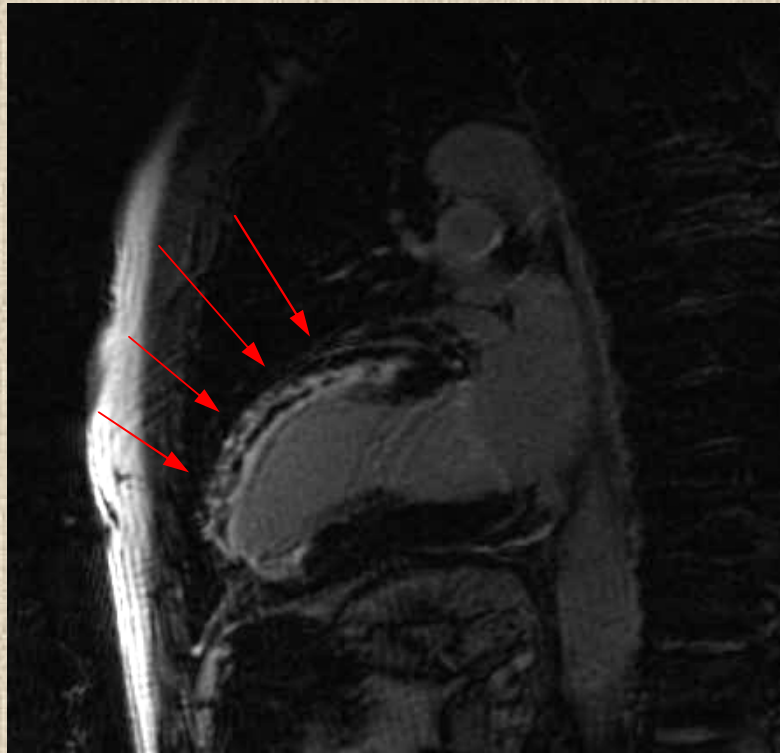




SEQUENZE CONTRASTOGRAFICHE



**IRGE: INVERSION RECOVERY GRADIENT-ECHO:
SCAR -CICATRICE**



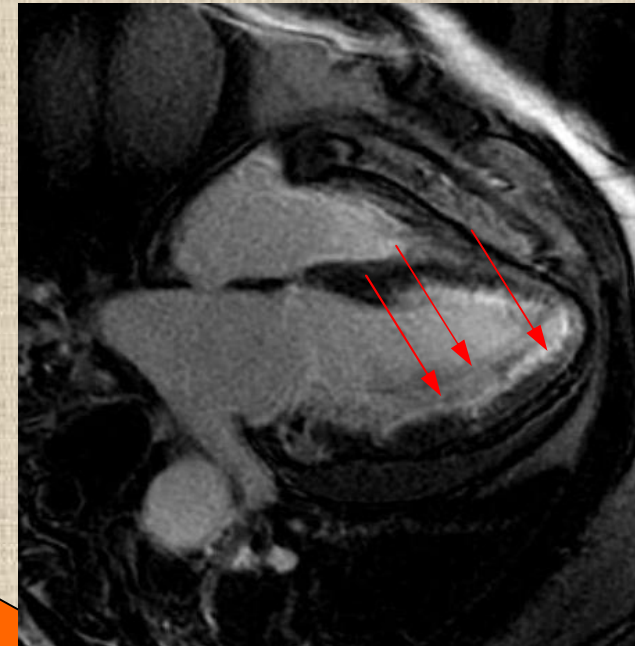
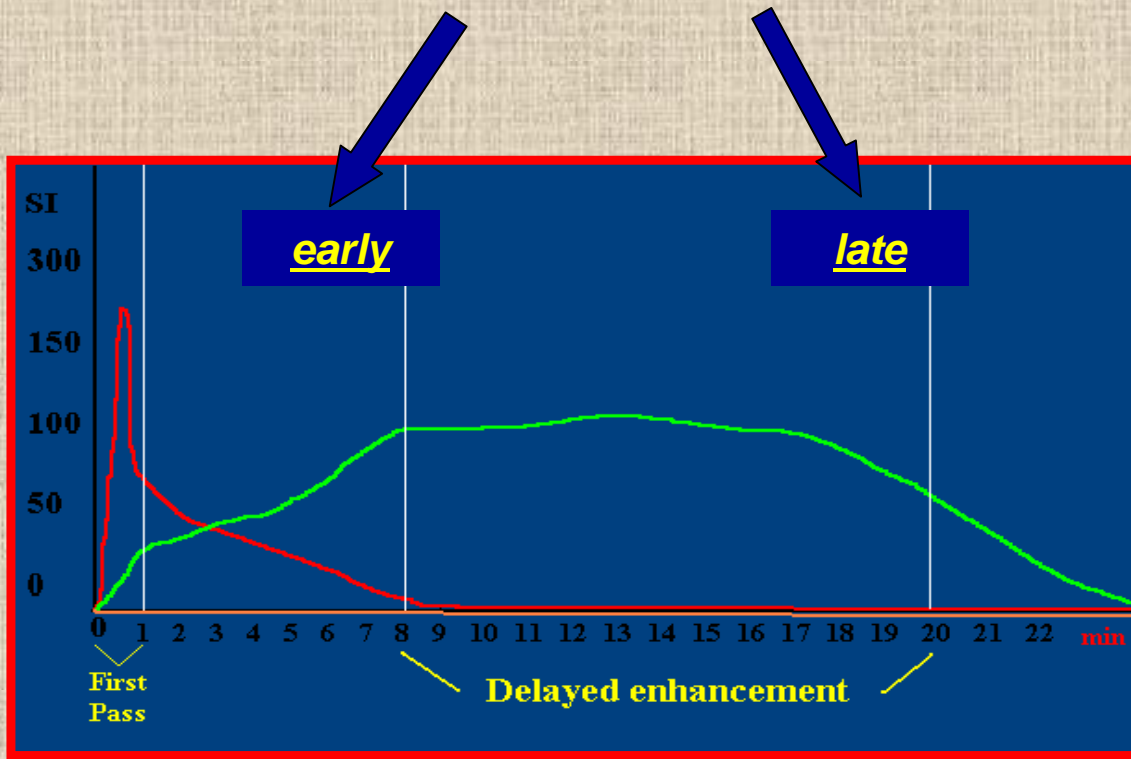


SEQUENZE POST CONTRASTOGRAFICHE



IRGE: INVERSION RECOVERY GRADIENT-ECHO

EARLY E LATE DELAYED ENHANCEMENT:



cicatrice

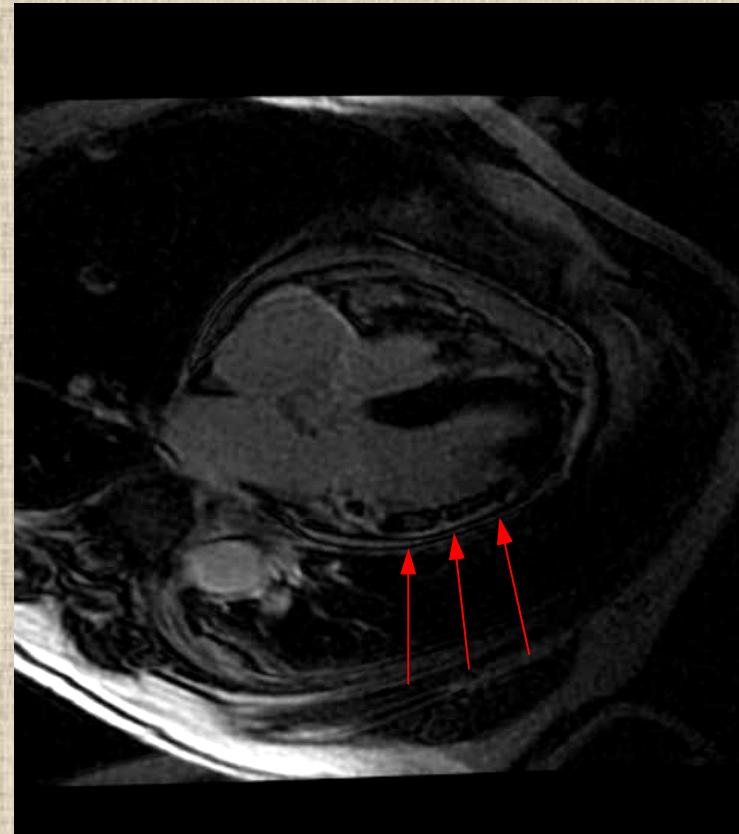
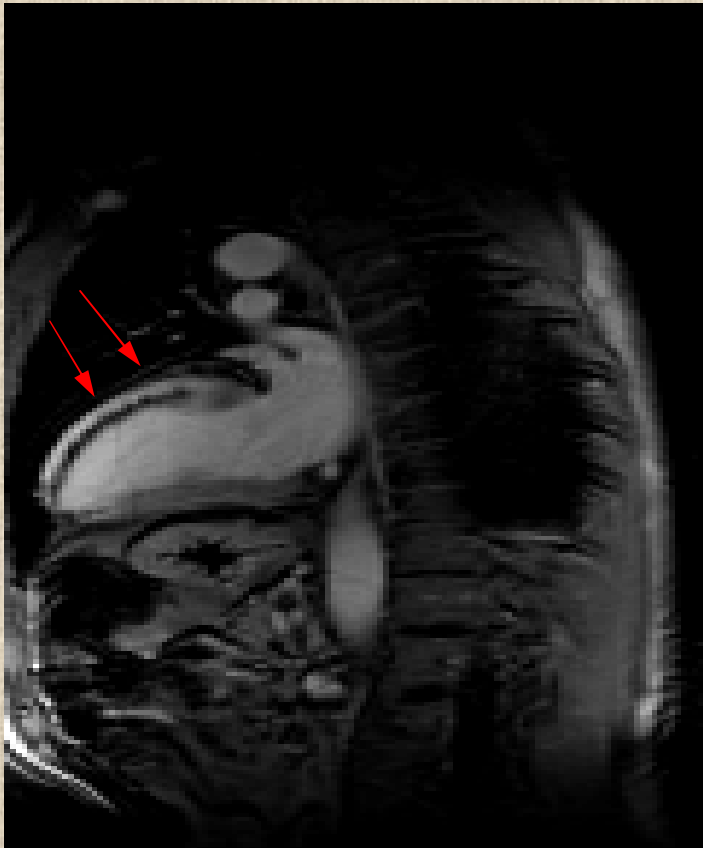


INVERSION RECOVERY GRADIENT-ECHO

EARLY DELAYED ENHANCEMENT (TI 400-500)

NO REFLOW

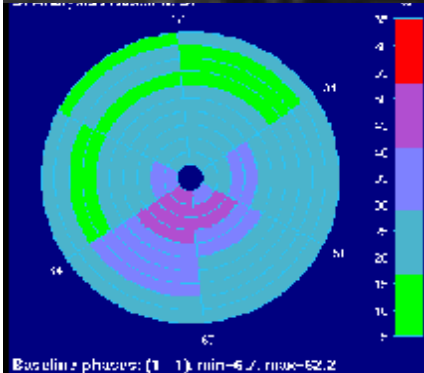
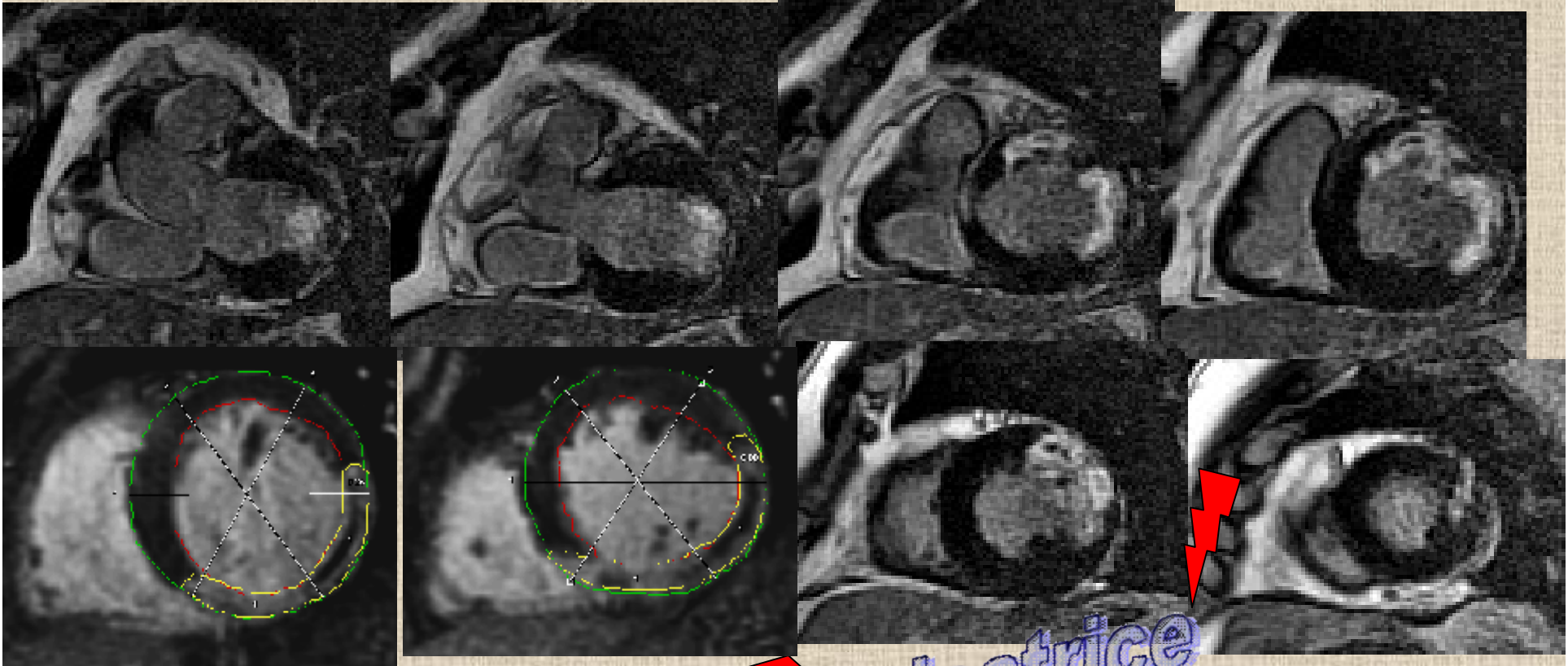
EMORRAGIA





IRGE: LATE ENHANCEMENT:

→ **asse corto (TI 400-500): valutazione anche quantitativa**



N° DI SEGMENTI COINVOLTI

+
ESTENSIONE
TRANSMURALE

(0-25%, 25-50%,
50-75%, 75-100%)

+
-ESTENSIONE

cicatrice

**DE: VALORE GLOBALE,
(gr. e % sulla massa)**

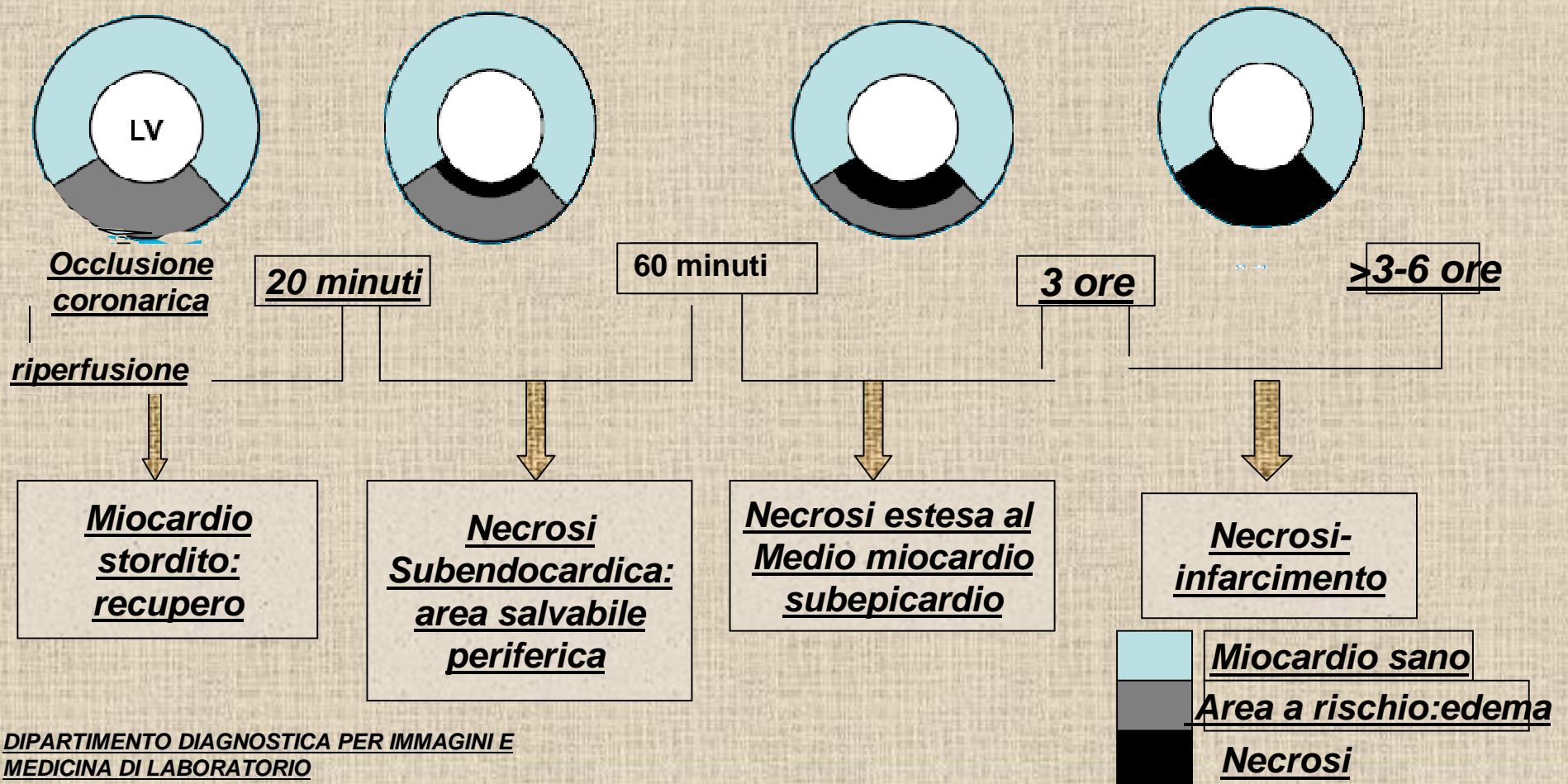


transmural wave front of necrosis

FASE ISCHEMICA ACUTA

Danno: ischemia reversibile

Danno: ischemia irreversibile

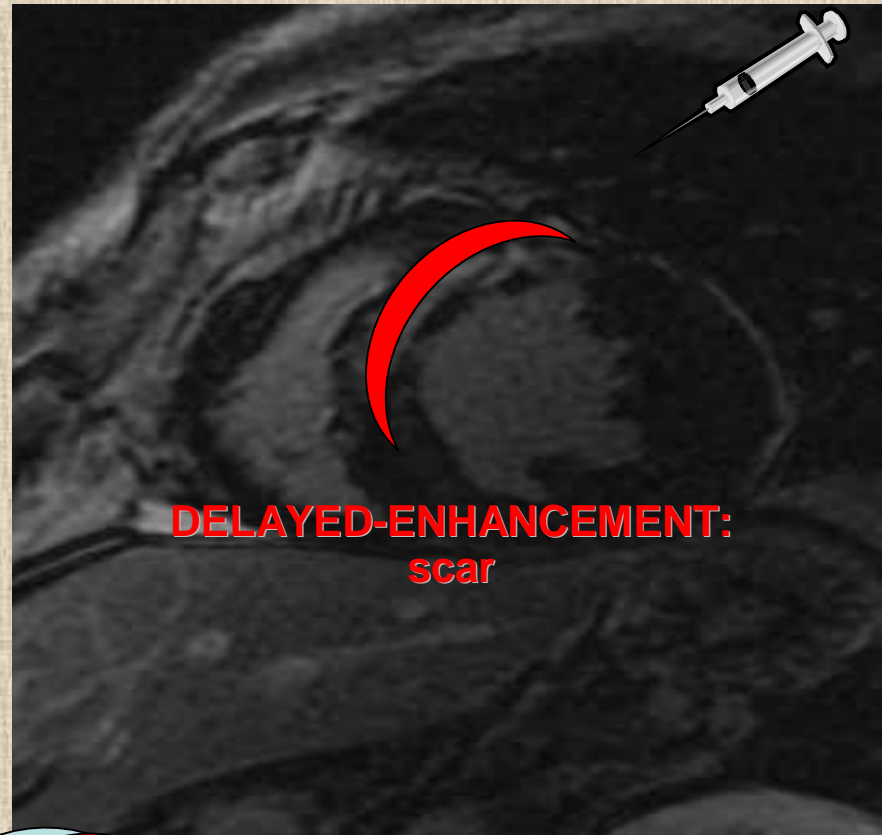




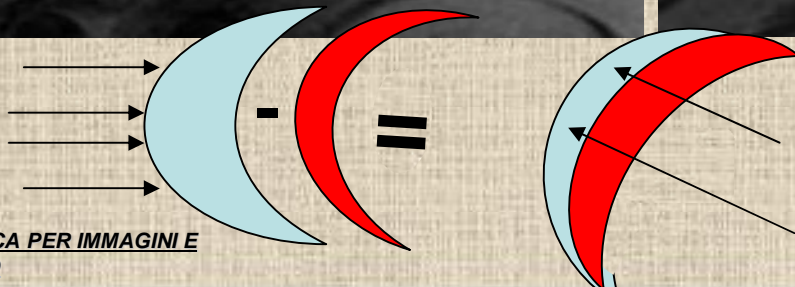
Delayed enhancement –edema= area a rischio



T2-STAR:
edema

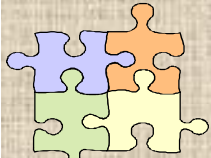


DELAYED-ENHANCEMENT:
scar

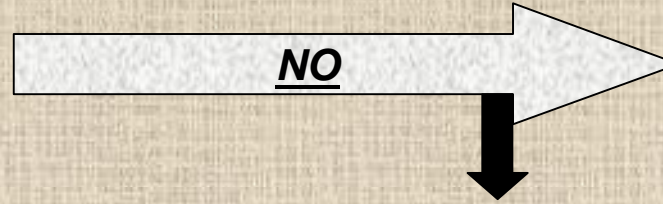


AREA SALVABILE

.....TEMPO.....

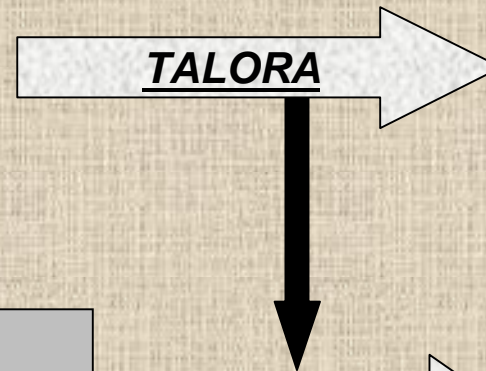


EDEMA	
DE <25%	AREA SALVABILE



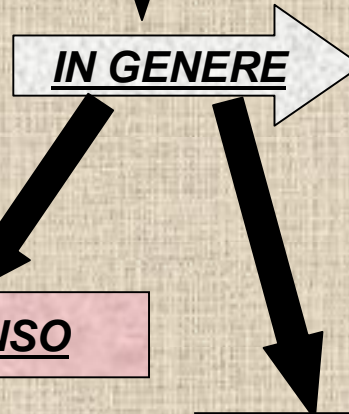
NO REFLOW
EMORRAGIA

EDEMA	
DE 25-75%,	AREA SALVABILE



NO REFLOW
EMORRAGIA

EDEMA	
DE >75%	AS



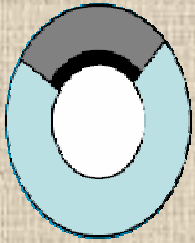
NO REFLOW
EMORRAGIA

SCOMPENSO



RIMODELLAMENTO





ARTERIA DISCENDENTE ANTERIORE

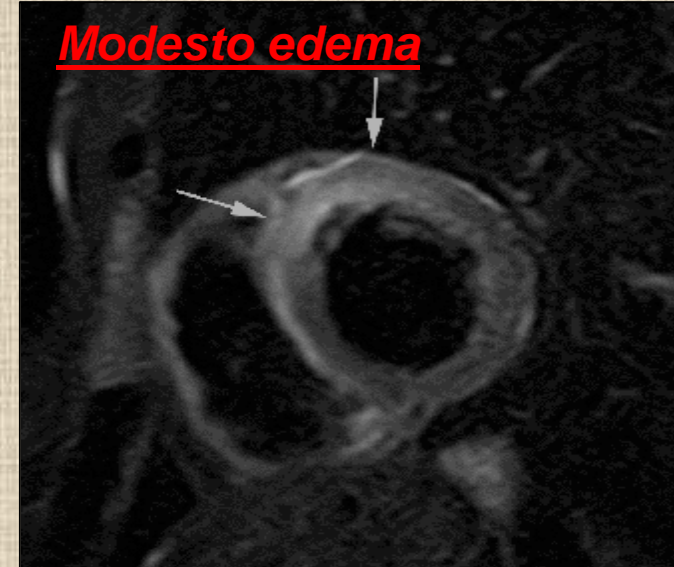
Circoscritto IMA antero-settale:  area salvabile 18%  



Lieve ipocinesia



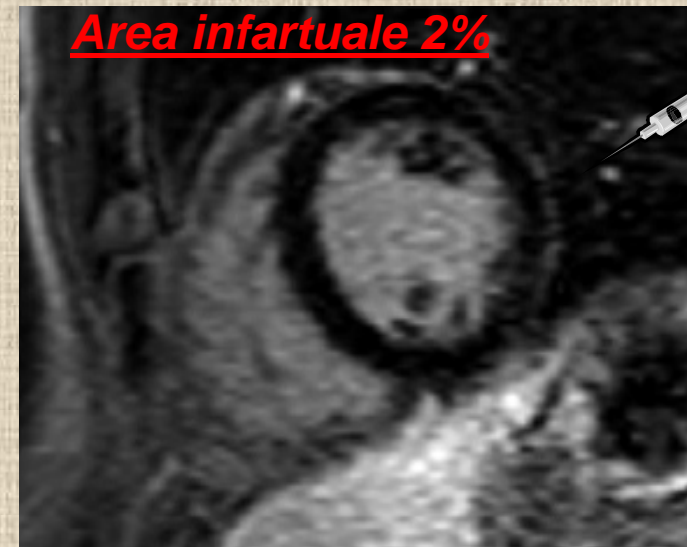
Modesto edema

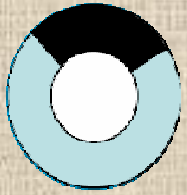


Non difetti di perfusione






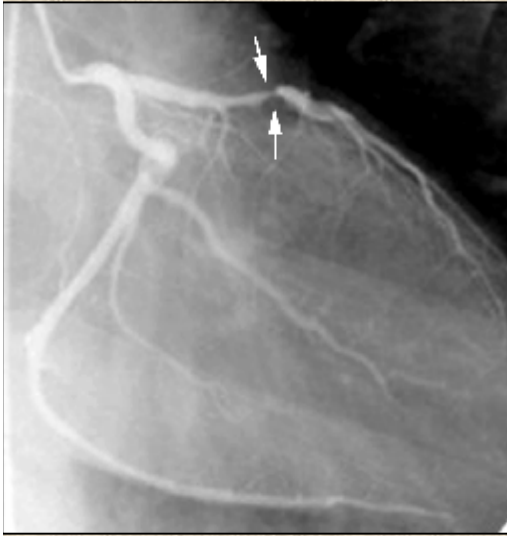
Area infartuale 2%



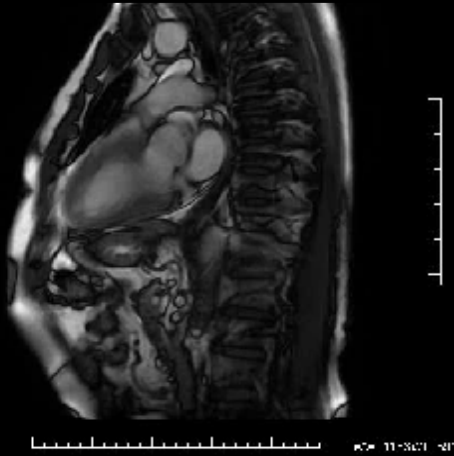


ARTERIA DISCENDENTE ANTERIORE

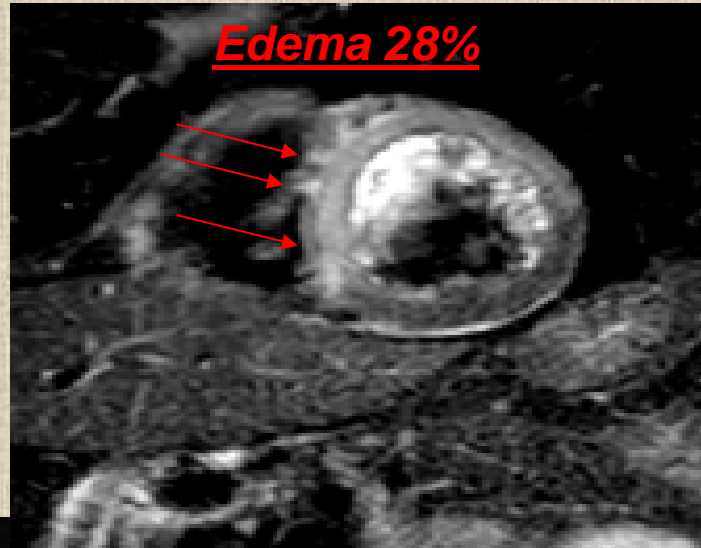
esteso IMA antero-settale:  area salvabile 3%  



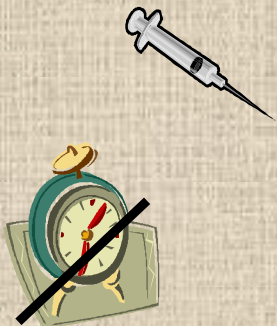
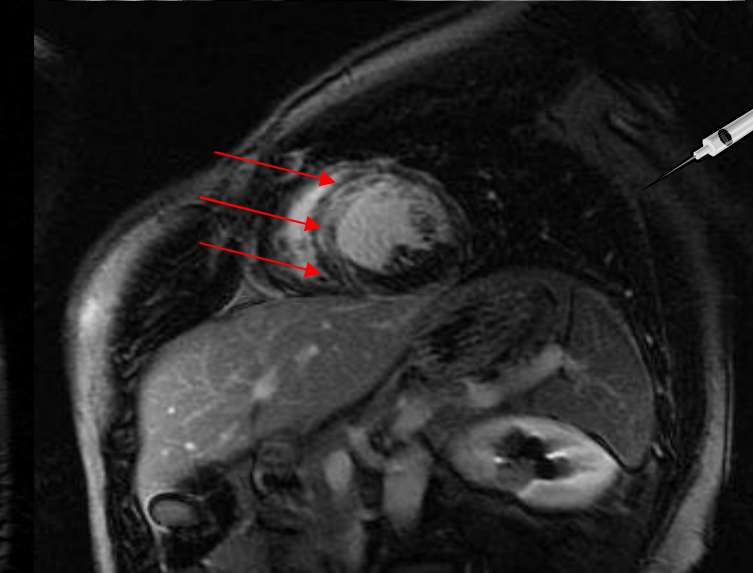
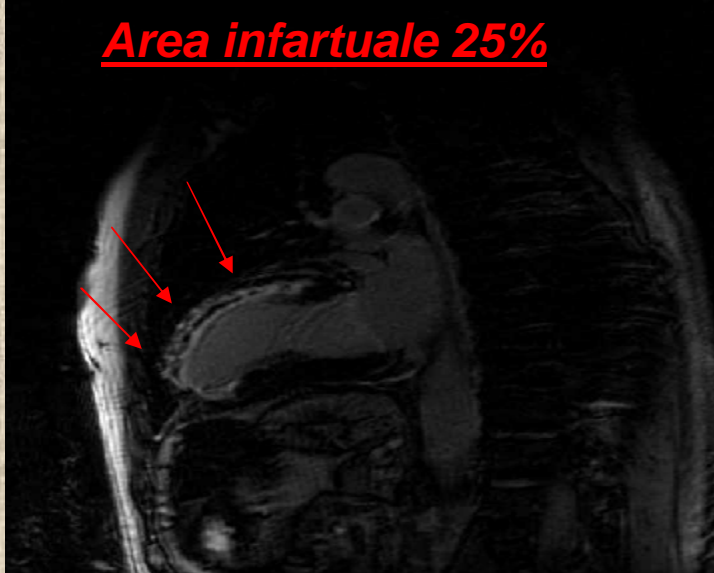
Acinesia parete anteriore

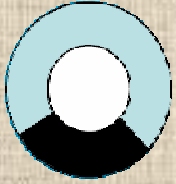


Edema 28%



Area infartuale 25%





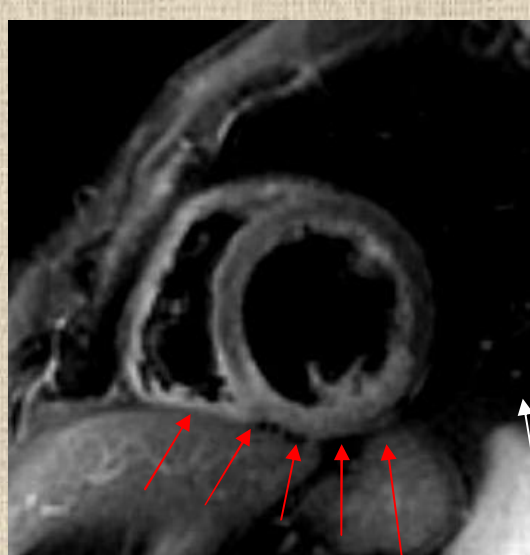
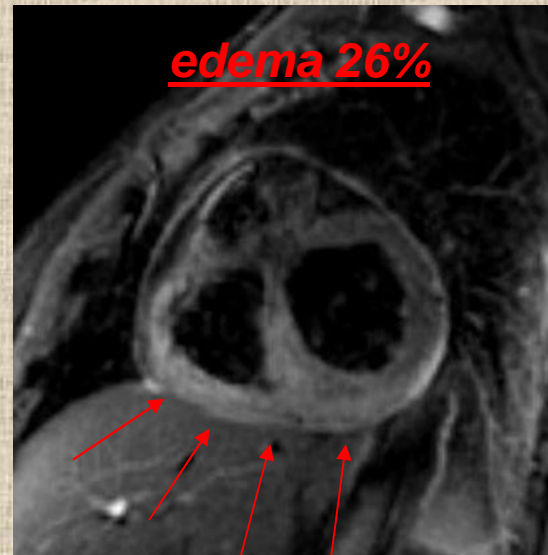
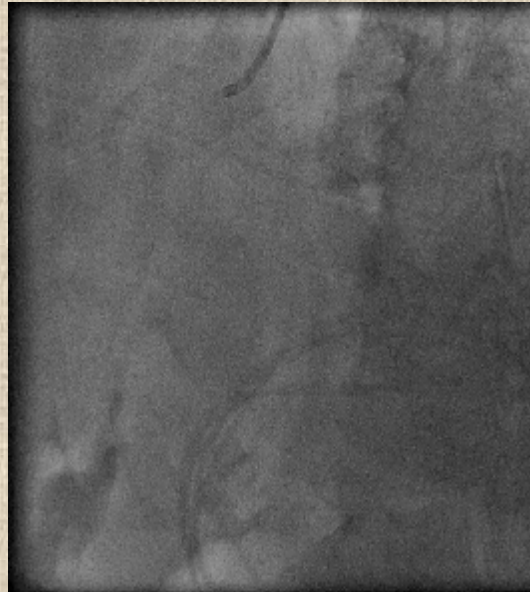
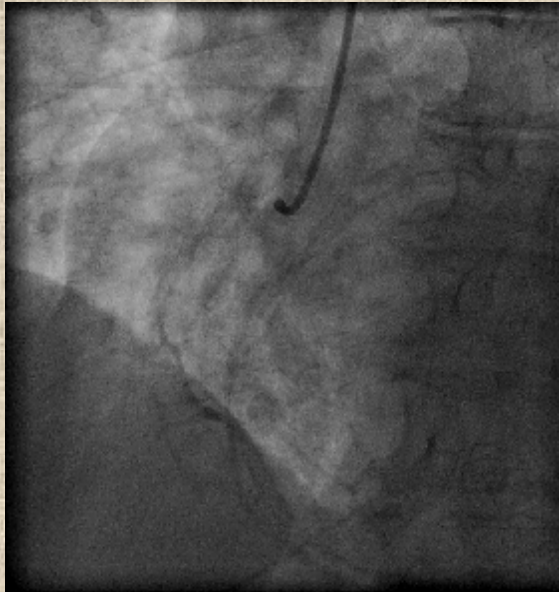
ARTERIA CORONARIA DESTRA

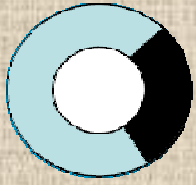


IM basale settale e parete inferiore



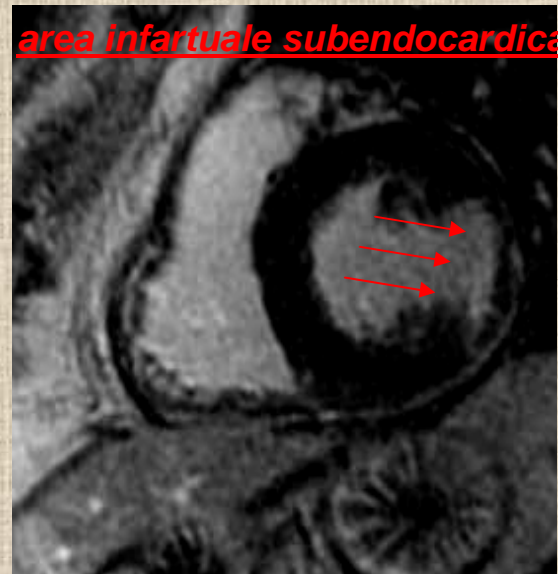
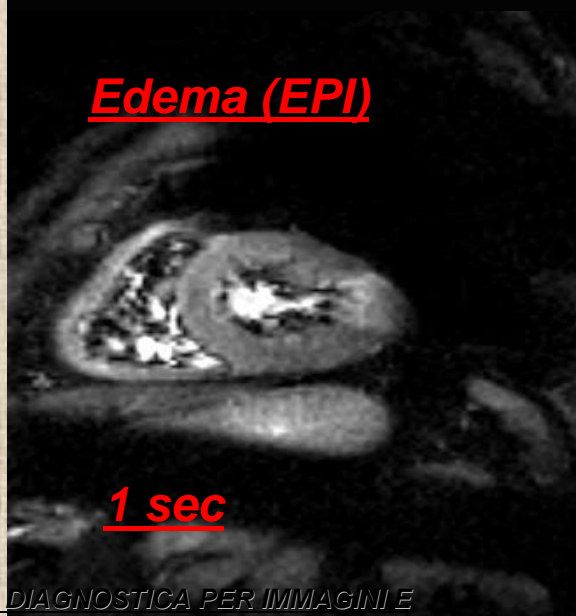
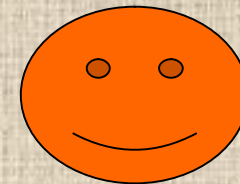
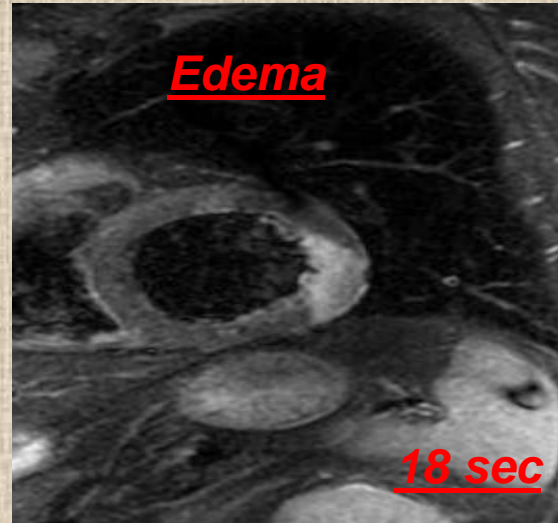
area salvabile 14%

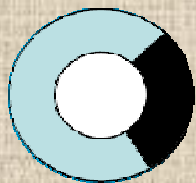




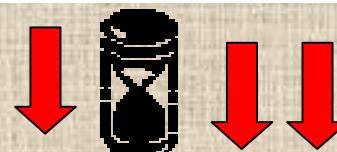
ARTERIA CIRCONFLESSA

circoscritto IM laterale:



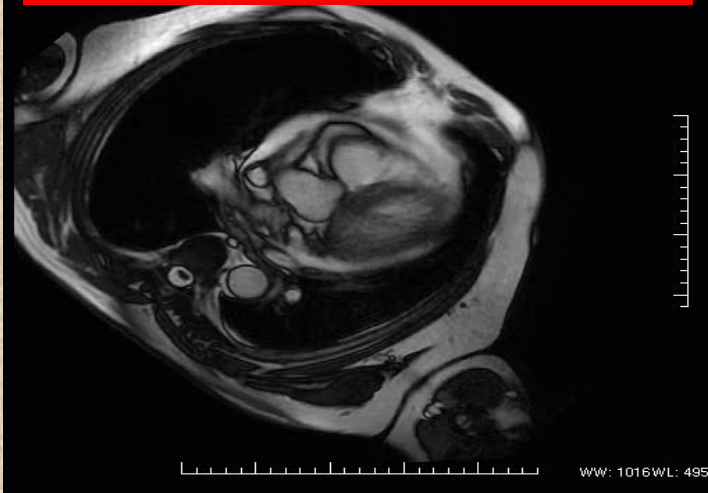


ARTERIA CIRCONFLESSA



esteso IM Infero-laterale: **EMORRAGIA: area salvabile 0%**

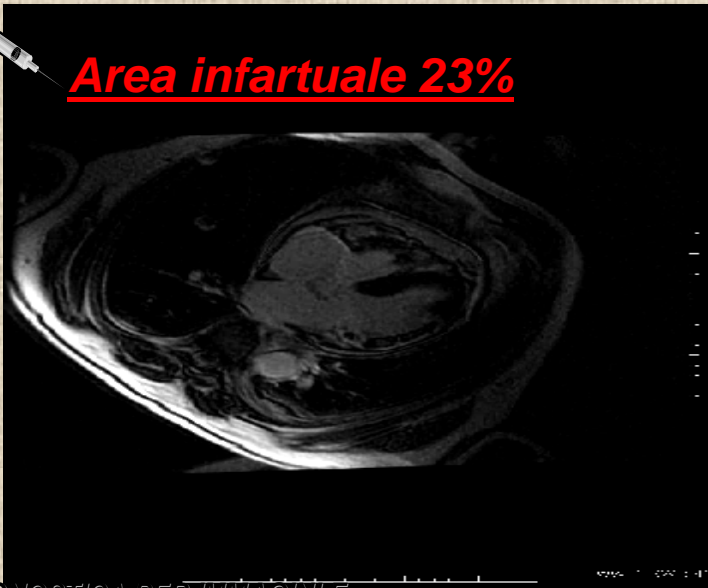
Acinesia parete inferolaterale



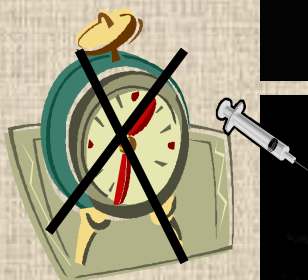
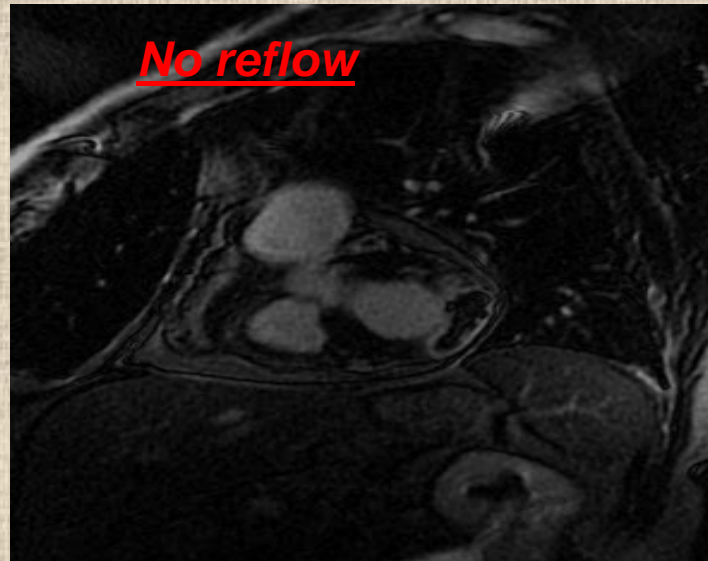
Edema-emorragia



Area infartuale 23%



No reflow





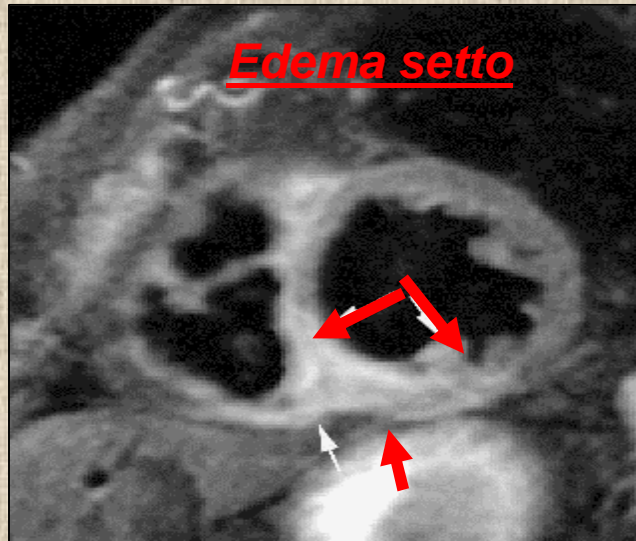
.....**TUTTO COSI' SEMPLICE????**.....



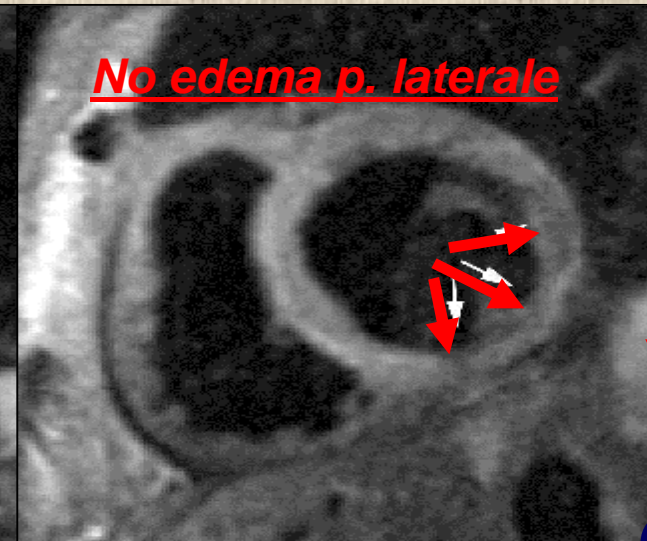
.....**infarto Acuto e Cronico**.....



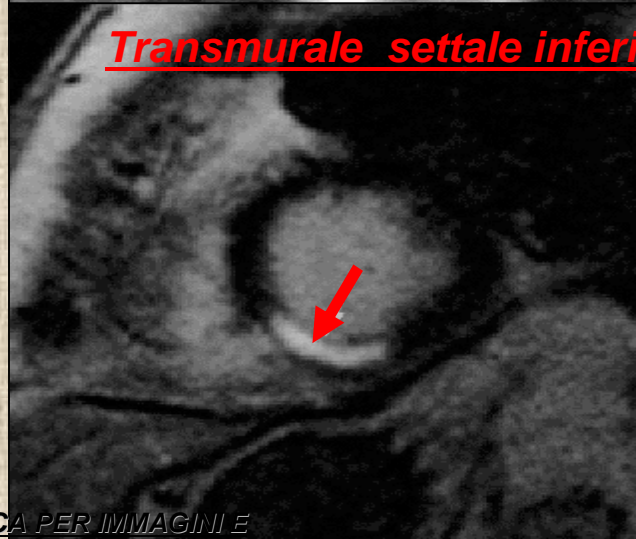
Acuto



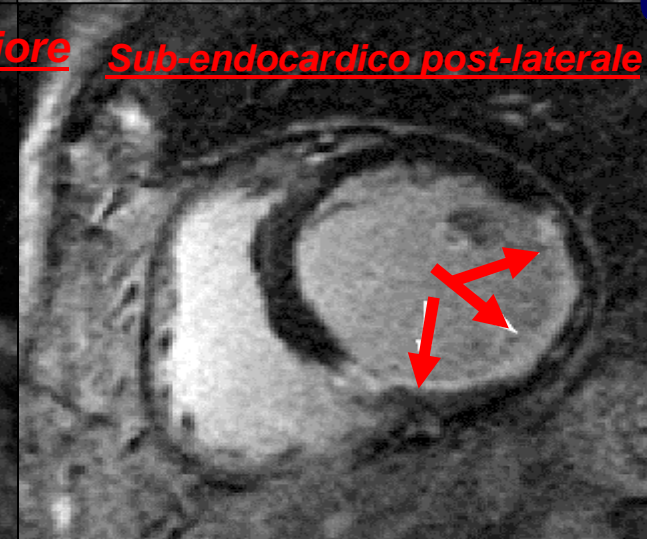
Edema setto



No edema p. laterale

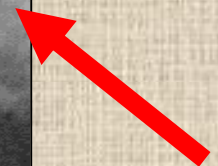


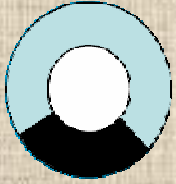
Transmurale settale inferiore



Sub-endocardico post-laterale

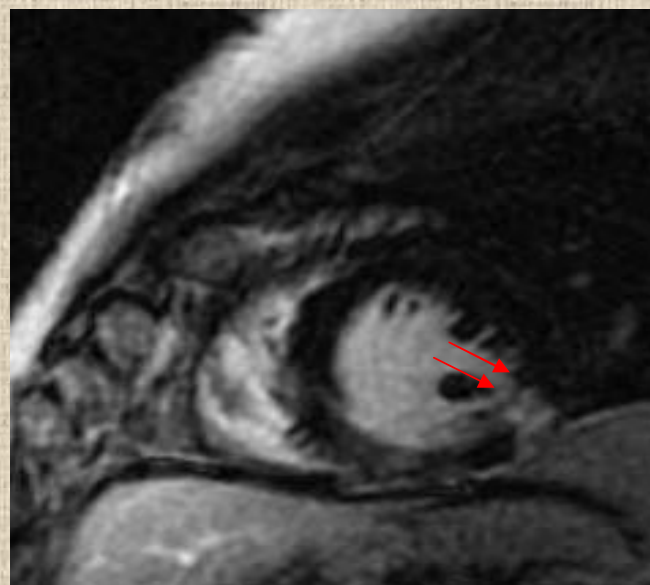
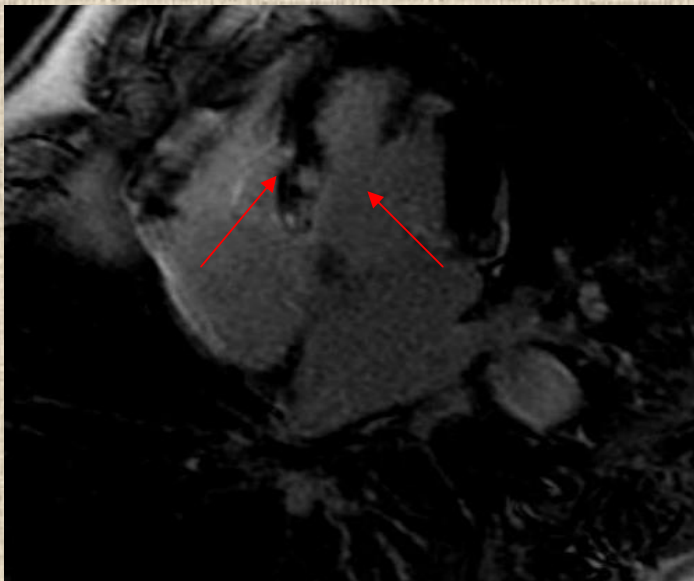
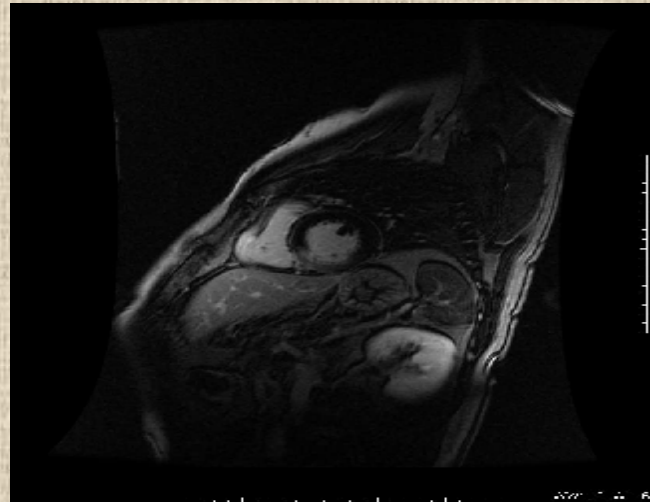
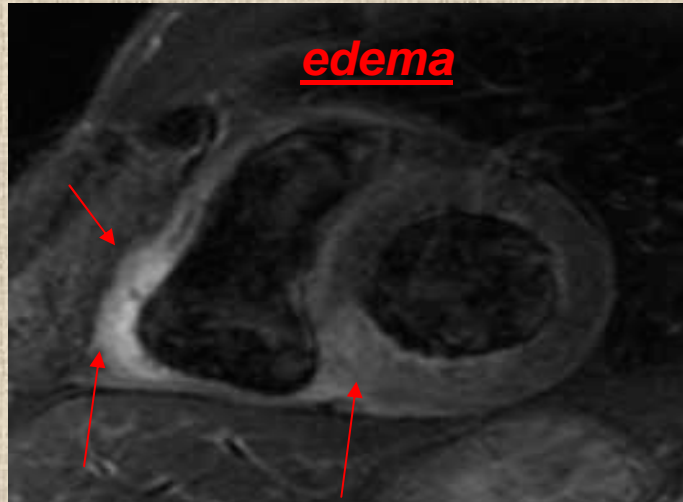
Cronico

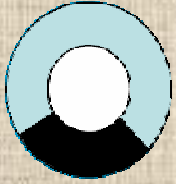




.....**TUTTO COSI' SEMPLICE????**.....

ARTERIA CORONARIA DESTRA

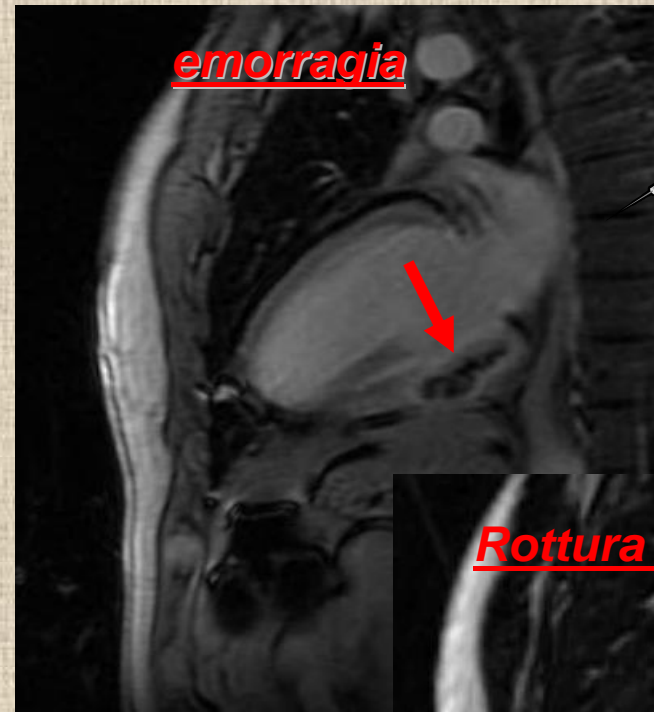
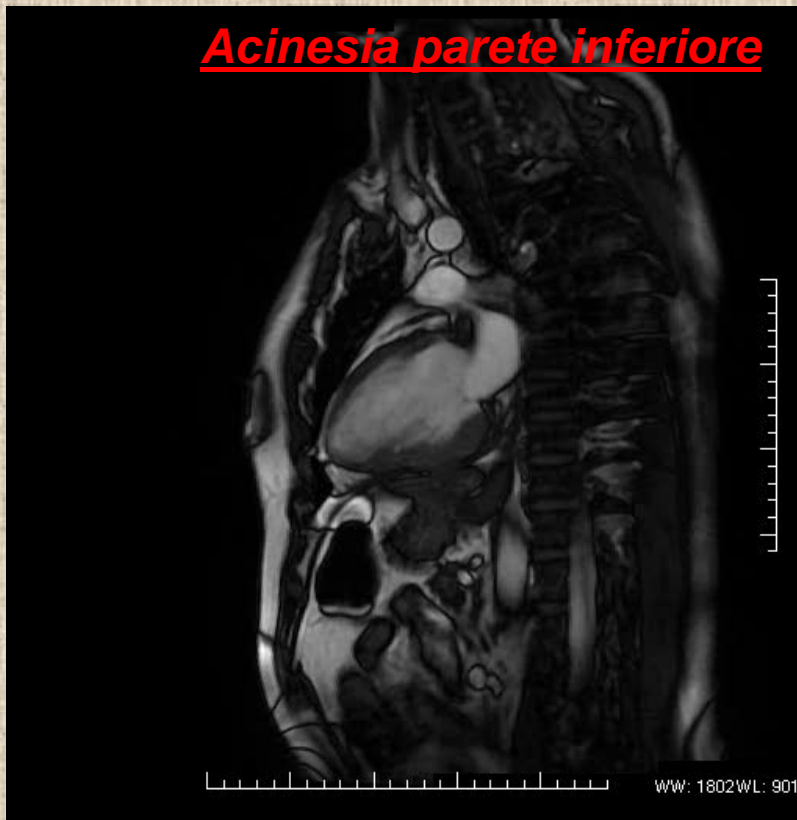


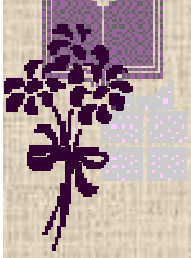


.....TUTTO COSI' SEMPLICE???.....



.....cosa e' successo ???.....





.....emodinamica cardiologia....
.....radiologia –RM....



-settembre 2010: stesura e approvazione
PROTOCOLLO INFARTO



-ottobre 2010: inizio studio pazienti (3-5 giorni)

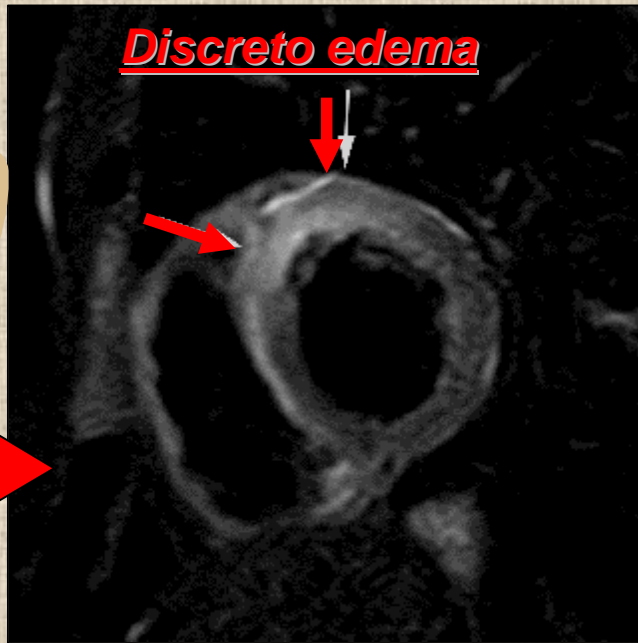
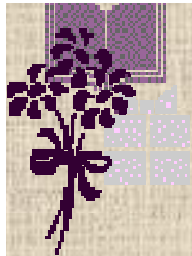


-aprile 2011: inizio follow-up (6-8 mesi)

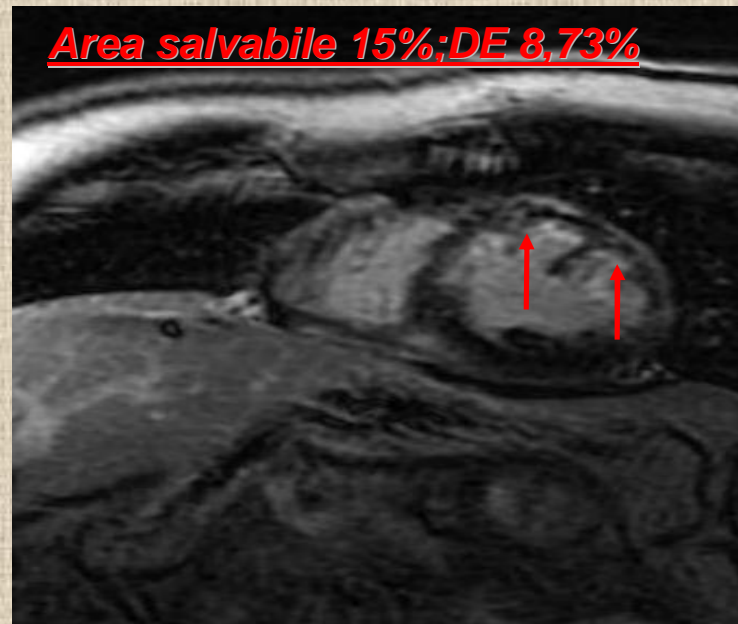
..studiati 30 pazienti....



.....primi controlli....



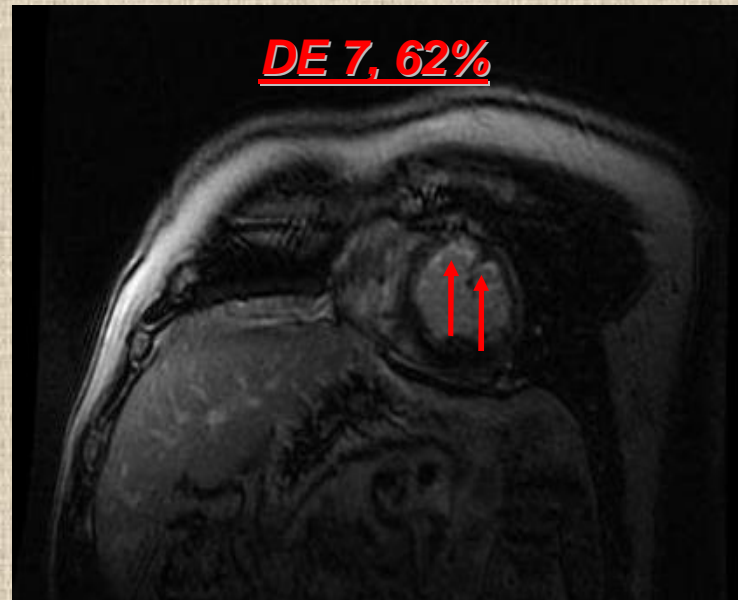
acuto →



FE:42%

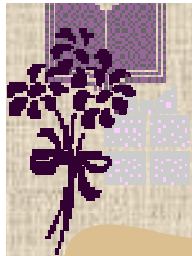


→ **6 mesi**

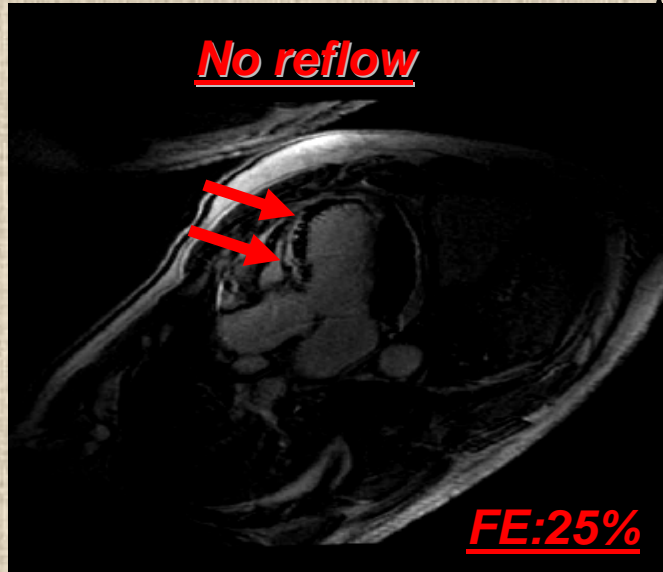
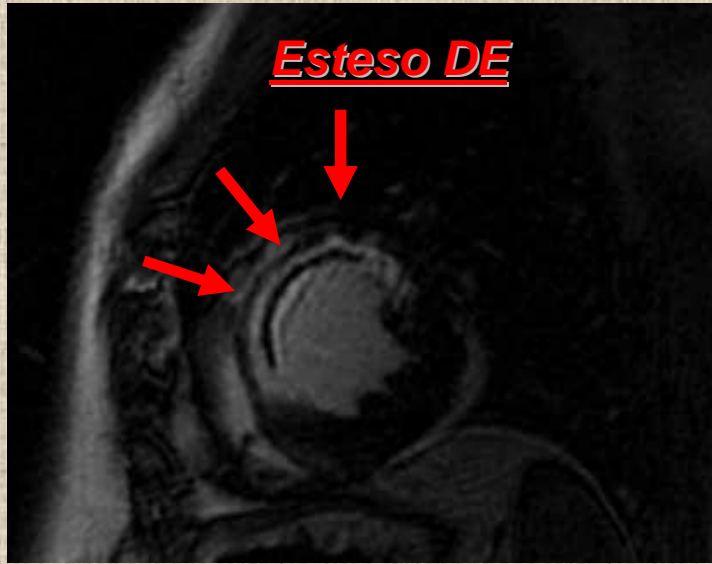


FE:53%

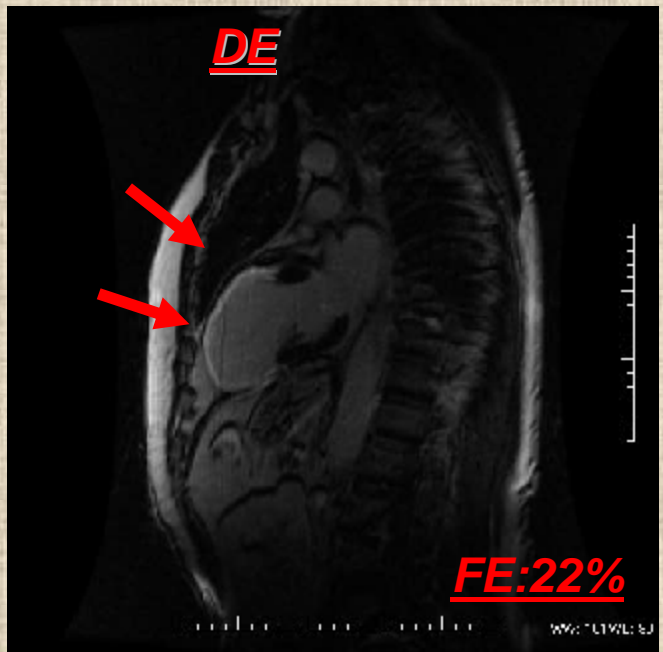
.....primi controlli....: evoluzione aneurismatica



acuto



6 mesi





*grazie a tutti quelli che continuano
a lavorare con noi "al progetto cuore"*