RADIOTHERAPY IN ACUTE LEUKEMIAS

RADIATION THERAPY IN ALL

- PROPHYLACTIC CRANIAL IRRADIATION
- THERAPEUTIC CRANIAL IRRADIATION
- THERAPEUTIC CRANIAL AND NEURAXIS RADIATION
- TESTICULAR IRRADIATION
- MEDIASTINAL IRRADIATION
- TOTAL BODY IRRADIATION – BMT CONDITIONING

DEFINITION OF RISK GROUPS ALL BFM 95

- STANDARD RISK (**6 CRITERIA**)
- PREDNISONE GOOD RESPONSE(BLASTS <1000 /MICROLIT OF PERIPHERAL BLOOD ON DAY 8) AFTER A 7 DAY PREDNISONE PREPHASE(PRED-GR)
- WBC <20,OOO/MICRO LIT AND AGE >1-<6 YEARS
- A COMPLETE REMISSION ON DAY 33 (M1-MARROW)
- NO TRANSLOCATION t(9:22) OR BCR/ABL RECOMBINATION
- NO TRANSLOCATION t(4:11) OR MLL /AF 4 RECOMBINATION
- NO T – IMMUNOLOGY

MEDIUM RISK GROUP

(4+1 or more)

- LEUKEMIC CELLS <1000/MICROLIT IN THE PERIPHERAL BLOOD ON DAY 8(PREDNISONE–GR)
- COMPLETE REMISSION ON DAY 33(M1-MARROW)
- NO TRANSLOCATION t (9:22) OR BCL/ABL RECOMBINATION
- NO TRANSLOCATION t(4:11) OR MLL/AF 4 RECOMBINATION
- LEUKOCYTES MORE THAN 20,000 /MICROLIT,AGE LESS THAN ONE YEAR OR MORE THAN 6 YEARS

HIGH RISK GROUP(**EVERY CRITERION**)

- MORE THAN 1000/ MICROLIT LEUKEMIC CELLS IN PERIPHERAL BLOOD ON DAY 8 (PRED=PR)
- NO COMPLETE REMISSION ON DAY 33
- TRANSLOCATION t(9:22) OR BCR/ABL RECOMBINATION
- TRANSLOCATION t(4:11) OR MLL/AF4 RECOMBINATION

DEFINITION OF CNS STATUS

- **CNS STATUS 1(NEGATIVE):**
-
- NO CLINICAL EVIDENCE OF A CNS DISEASE

- NO IMAGING-CT/MRI -EVIDENCE OF CNS LESION
-
- NORMAL FUNDOSCOPIC FINDING

- BLAST FREE CSF

DEFINITION OF CNS STATUS

- **CNS STAUS 2 (NEGATIVE**):
- BLASTS UNAMBIGUOUSLY IDENTIFIED, RBC:WBC <100:1 ON CYTOPSIN PREPARATION OF CSF WITH A CELL COUNT OF <5/MICROLIT- NON TRAUMATIC UN CONTAMINATED CSF

- BLASTS IDENTIFIED, RBC:WBC >100:1 ON CYTOPSIN PREPARATION OF CSF- TRAUMATIC BLOOD CONTAMINATED CSF

- TRAUMATIC LP (BLOOD CONTAMINATED CSF)

DEFINITION OF CNS STATUS

- **CNS STATUS 3(POSITIVE**)
- A MASS LESION IN THE BRAIN AND OR MENINGES ON CT/MRI
- CRANIAL NERVE PALSY UNRELATED TO OTHER ORIGIN EVEN IF THE CSF IS BLAST FREE OR NO CIRCUMSCRIBED SPACE OCCUPYING LESION ON MRI/CTSCAN
- PURE RETINAL INVOLVEMENT WITH BLAST FREE CSF AND NO MASS ON CT/MRI
- NON TRAUMATIC LP WITH A CSF CELL COUNT OF >5/MICROLIT

CRANIAL PROPHYLAXIS - ALL

- ALL-BFM 83- 12 GY OF PREVENTIVE CRT WAS AS EFFECTIVE AS 18 GY OF HIGH-SRG
- ALL-BFM 90- REDUCTON OF LONG TERM MORBIDITY IN PRED-GR PATIENTS BY LIMITING RADIATION DOSE -12 GY TO MR-ALL AND HR
- ALL -86 TO 90-IN CRITICAL GROUPS INCIDENCE OF CNS RELAPSE WAS LESS THAN 5 %.ESPECIALLY WITH HD-MTX AND MTX -IT INCIDENCE WAS LESS THAN 3 %
- ALL-BFM-90-12 GY INSTEAD OF 18 GY PROVIDED EQUALLY EFFICIENT CNS PROPHYLAXIS IN HIGH RISK GROUPS HAD PGR
- AMERICAN STUDIES –MR PATIENTS WITH T-ALL HAD HIGHER INCIDENCE OF SYSTEMIC AND CNS RELAPSE IN NON IRRADIATED PATIENTS

ALL-BFM 95

CRANIAL PROPHYLAXIS

- CHILDREN AND ADOLESCENTS<18YRS) WITH **MEDIUM RISK GROUP WITH T-ALL AND ALL HIGH RISK GROUP PATIENTS**
- NO RT FOR STANDARD RISK AND MEDIUM RISK PATIENTS (EXCEPT T -ALL)
- DOSAGE :AGE- LESS THAN ONE YEAR-NO RT
  AGE- ONE YEAR OR MORE -**12GY**
- ADULT PROTOCOLS-**18 TO 24GY**

CRANIAL IRRADIATION

- DOSAGE
- CHILDREN LESS THAN ONE YEAR- NO IRRADIATION
- ONE TO TWO YEARS -12 GY
- MORE THAN 2 YEARS-18 GY
- ADULT ALL PROTOCOLS-24 TO 30Gy

CRANIAL IRRADIATION TECHNIQUE

- HIGH VOLTAGE CONDITIONS WITH TELECOBALT-60 MACHINE OR LINEAR ACCLERATOR-PHOTON ENERGIES MORE THAN 6 MV SHOULD NOT BE USED SO THAT THE BUILD UP REGION AT INITIAL DEPTH IS SUPERFICIAL TO THE MENINGES.

- DAILY SET UP-MASK TECHNIQUE

- IRRADIATION VOLUME-WHOLE NEUROCRANIUM WITH BOTH UPPER VERTEBRA (C2),THE RETROBULBAR TISSUE AND THE COMPLETE CRANIAL BASE WITH ITS MIDDLE CRANIAL GROOVE.

CRANIAL IRRADIATION TECHNIQUE

- EVERY FIELD SHOULD BE TREATED IN EVERY SESSIONS
- DAILY SINGLE DOSE IS 1.5 GY .THIS IS ADMINISTERED IN 5 SESSIONS PER WEEK UNTIL THE TOTAL DOSE HAS BEEN APPLIED
- ANGULATION OF THE BEAM (3-5 DEG POSTERIOR),HALF BEAM- TO AVOID OPTHALMOLOGICAL COMPLICATIONS

NEURAXIS IRRADIATION

- INDICATIONS-OVERT CNS LEUKEMIA IN ADULTS, ISOLATED CNS RELAPSE UNSUITABLE FOR CHEMOTHERAPY.
- DOSAGE- TO THE CRANIUM -24 TO 30 GY. TO THE SPINE-15 TO 18GY. 1.5 TO 1.8 GY /FRACTION.

NERURAXIS IRRADIATION

- FIELDS-LATERAL PARALLEL OPPOSED CRANIAL FIELDS,POSTERO-ANTERIOR SPINAL FIELDS
- COUCH AND GANTRY ROTATION-TO MATCH THE FIELDS
- MAXIMUM BEAM ENERGY 6 MV

TESTICULAR INVOLVEMENT

- INITIAL TESTICULAR INVOLVEMENT-RECENT OCCURRENCE OF A PAINLESS SWELLING OF THE TESTES WITHOUT SIGNS OF INFECTION,THEN A SONOGRAPHICAL EXAMINATION OF BOTH TESTES IS NECESSARY AND A BIOPSY IS NOT NECESSARY.

- IF UNCERTINITY EXISTS- ILLNESS INVOLVING INFECTION OR VASCULAR CHANGES OF THE TESTIS SHOULD BE RULED OUT AND A TESTIS BIOPSY SHOULD BE PERFORMED.

TESTICULAR INVOLVEMENT

- MANAGEMENT-IN THE CASE OF TESTICULAR INVOLVEMENT NO UNILATERAL OR BILATERAL ORCHIDECTOMY IS PLANNED.

- IF THE TESTICLE SIZE NORMALIZES COMPLETELY AFTER THE PROTOCOL AT THE LATEST ACCORDING TO TACTILE AND SONOGRAPHIC FINDINGS THERE IS NO EXTRA TESTICULAR IRRADIATION.

- IF AFTER THE PROTOCOL A DOUBTFUL CLINICAL FINDINGS REMAINS,BIOPSY IS REQUIRED AND IN CASE OF INVOLVEMENT LOCAL IRRADIATION MUST BE APPLIED.

TESTICULAR RELAPSE

- TESTICULAR RELAPSE-UNILATERAL OR BILATERAL PAINLESS BUT HARD SWELLING OF THE TESTIS (VOLUME >2) AND A BIOPSY SHOULD BE DONE.
- COMMON WITH T CELL ALL
- USUALLY FOLLOWS SYSTEMIC AND CNS RELAPSE
- POOR PROGNOSTIC FACTOR
- 1970-5%-15%
- WITH HD MTX-<2%
- MANAGEMENT:BOTH INTENSIVE SYSTEMIC THERAPY AND LOCAL RADIOTHERAPY

TESTICULAR IRRADIATION

- UNILATERAL IRRADIATION OR ORCHIDECTOMY AS LOCAL MANAGEMENT WAS FELT TO BE ASSOCIATED WITH A SIGNIFICANT RISK OF CONTRALATERAL DISEASE JUSTIFYING TREATMENT DIRECTED AT BOTH TESTIS FOR LEUKEMIA MANAGEMENT.

- 24 TO 30 GY OVER 2 TO 3 WKS(200CGY-300CGY/#)

TESTICULAR IRRADIATION

- TESTICULAR IRRADIATION IS ADMINISTERED VIA A SINGLE ANTERIOR PORTAL WITH THE USE OF ELECTRON BEAM OF APPROPRIATE ENERGY OR LOW ENRGY PHOTONS

- PATIENT IN A SUPINE POSITION AND THE PENILE SHAFT TAPPED UP AND OVER THE SYMPHYSIS PUBIS

- RECTANGULAR FIELD WITH MINIMUM OF 5 MM MARGIN TO THE SCORUM (INCLUDES BOTH TESTIS AND EPIDIDYMIS)

TESTICULAR IRRADIATION

- 10X10 CMS CONE PROVIDES ADEQUATE COVERAGE
- MOST APPROPRIATE ELECTRON ENERGY -9 TO 12 MEV
- A POLYSTERENE /LEAD BLOCK IS USED TO SUPPORT TESTIS AND SHIELD THE PERINEUM
- SKIN APPOSITION OF THE BEAM CAN BE ACHIEVED BY ANGLING THE GANTRY

TESTICULAR IRRADIATION

- IN THE ABSENCE OF ELECTRON BEAMS LOW ENERGY PHOTONS CAN BE USED(4 TO 6 MEV).

- TO ACHIEVE DOSE HOMOGENICITY .5 TO 1 CMS OF BOLUS OVER THE ENTIRE SCROTAL AREA MAY BE NECESSARY.

- SHIELDING OF THE UNDER LYING PERINEAL TISSUE IS PROBLAMATIC
- THE EXIT DOSE WILL BE HIGH.

MEDIASTINAL IRRADIATION

- IF A MEDIASTINAL TUMOR RECEDES <30% OF ITS ORIGINAL SIZE BY DAY 33(MEASUREMENT CRITERIA –MAXIMAL DIAMETER TAKEN AT D5), THEN PHASE II OF THE SAME PROTOCOL IS TO BE CONTINUED.
- IF THE MEDIASTINAL TUMOR HAS NOT COMPLETELY RECEEDED BY DAY 33 (REMAINING TUMOR >30% OF ORIGINAL SIZE), THEN THE PATIENT IS PLACED IN THE HR BRANCH.
- IF ANY RESIDUAL TUMOR REMAINS IN THE CT /MRI AFTER A WEEK OF PROTOCOL THAT CAN BE RESECTED FOR HPE AND MOLECULAR GENETICS

MEDIASTINAL IRRADIATION

- IF NO VITAL INFILTRATES ARE FOUND CONTINUE IN THE SAME BRANCH.IF VITAL INFILTRATES ARE FOUND CONSIDER MEDIASTINAL IRRADIATION.
- DOSE-30-40 GY
- ALL T CELL PHENOTYPE WILL RECEIVE CONSOLIDATION RT.

TOTAL BODY IRRADIATION- BMT CONDITIONING

- TBI-CYTOTOXIC AND IMMUNOSUPPRESIVE AGENT.
- ELIMINATE RESIDUAL LEUKEMIA AND EQUALLY EFFECTIVE IN MEDULLARY AND EXTRAMEDULLARY REGION.
- IT PERMITS ENGRAFTMENT OF DONOR IMMUNE AND HAEMATOPOIETIC CELLS.THE DONOR IMMUNE CELLS GENERATE THE GRAFT VERSUS LEUKEMIA EFFECT, AN IMPORTANT COMPONENT IN THE ERADICATION OF HOST LEUKEMIA.

TOTAL BODY IRRADIATION

- ALLOGENIC TRANSPLANT-ALL IN SECOND REMISSION AFTER AN EARLY RELAPSE,HIGH RISK ALL (PH +) AFTER FIRST REMISSION
- DOSE-200 CGY GIVEN IN BID WITH 6 HOUR INTER FRACTION INTERVEL 3 DAYS TO THE TOTAL DOSE OF 12 GY .DOSE RATE AVERAGE 8 TO10 CGY PER MINUTE(MAXIMUM UP TO 15 CGY).

SEQULAE OF TREATMENT

- CNS IRRADIATION:(24 GY vs18 GY VS MTX) SOMLONENCE SYNDROME,PITUITARY DYSFUNCTION,COGNTIVE FUNCTION DEFECTS,LEUKOENCHEPHALOPATHY,SECONDARY MALIGNANCIES

- TESTICULAR IRRADIATION:STERILITY,LEYDIG CELL DYSFUCTION (RARE).

SUMMARY

- ROLE OF RT IN ALL:

- CRANIAL PROPHYLAXIS(MRG-T CELL ALL,HRG)
- CRANIAL TREATMENT (ALL CNS INVOLVEMENT)
- CRANIOSPINAL IRRADIATION (OVERT CNS INVOLVEMENT IN ADULT ALL,ISOLATED CNS RELAPSE)

SUMMARY

- TESTICULAR IRRADIATION (RESIDUAL,RELAPSE)
- MEDIASTINAL IRRADIATION (RESIDUAL,T CELL ALL,RELAPSE)
- TOTAL BODY IRRADIATION (SECOND REMISSION AFTER EARLY RELAPSE,HIGH RISK WITH FIRST REMISSION)