ELIGIBILITY:
The BEP protocol is the standard protocol for the adjuvant setting in stage I nonseminomas and for metastatic germ cell tumors. It may be used for patients with IGCCCG (International Germ Cell Consensus Classification) good (3 cycles) and intermediate (4 cycles) prognosis seminoma or nonseminoma as well as for poor risk (4 cycles) nonseminoma (irrespective of primary tumor location).

Adjuvant Criteria:
Clinical stage I nonseminoma with vascular invasion (“high risk”) which has a 50% risk of relapse if surveillance is not an option

Retroperitoneal lymph node dissection pathology demonstrating involvement estimated to be associated with greater than 50% risk of subsequent relapse: 5 or more nodes involved, any involved node greater than or equal to 2 centimeters in diameter, or involved lymph node with extracapsular extension.

Low Risk Metastatic:
Testis/retroperitoneal primary AND no non-pulmonary visceral metastases AND AFP less than 1000 mcg/L or serum hCG less than 5000 unit/L or LDH less than 1.5 x N. Mediastinal seminomas which are a low risk form of mediastinal disease. Please note: most mediastinal germ cell cancers are non-seminomas and are considered high risk (4 cycles) disease.

Intermediate Risk Metastatic:
Testis/retroperitoneal primary AND no non-pulmonary visceral mets AND Intermediate Markers:
- AFP greater than or equal to 1000 mcg/L but less than 10,000 mcg/L
- Serum hCG greater than or equal to 5000 unit/L but less than 50,000 unit/L
- LDH greater than or equal to 1.5 x N but less than 10 x N

High Risk Metastatic:
Mediastinal primary OR non-pulmonary visceral mets OR AFP greater than 10,000 mcg/L OR serum hCG greater than 50,000 unit/L OR LDH greater than 10 x N.

It is strongly recommended that all patients with metastatic germ cell tumours should be presented in GU tumour group conference and/or referred to a high volume center.

RELATIVE CONTRAINDICATIONS
Discussion with an expert center recommended:
- Inadequate renal function (calculated creatinine clearance less than 40 mL/min) (relative contraindication)
- Inadequate hematologic function
- Chronic pulmonary disease considered a risk factor for bleomycin toxicity
- Recent thoracic irradiation (bleomycin risk)
TESTS:

- **Baseline**: CBC and differential, platelets, liver enzymes (including LDH), creatinine, sodium, potassium, magnesium, calcium, AFP, serum hCG, CEA, random glucose, pulmonary function tests (if indicated).
- Consider baseline audiogram for pretreatment hearing impairment.
- Consider prechemotherapy sperm count and banking if fertility is an issue.
- Before each cycle: CBC and differential, platelets, creatinine, LDH, AFP, serum hCG, magnesium, sodium, potassium, random glucose.
- Repeat CBC on day 5 if ANC on day 1 less than 1.0 x 10⁹/L (not required on day 5 of the first cycle)
- Repeat creatinine on day 5 if creatinine on day 1 greater than the upper limit of normal
- Creatinine on day 8 and on day 15, if patient receiving bleomycin.

PREMEDICATIONS:

- Antiemetic protocol for highly emetogenic chemotherapy protocols (see SCNAUSEA).
- hydrocortisone and diphenhydRAMINE for history of hypersensitivity to etoposide

TREATMENT:

- **Cycle length 21 days regardless of ANC**
- **Duration by Risk Category:**
  1. **Adjuvant**: 2 cycles of GUBEPO (total bleomycin 180 unit)
  2. **Low Risk Metastatic**: 3 cycles of GUBEP (total bleomycin 270 unit), may be substituted for 4 cycles of GUEP only if contraindications for bleomycin (Cave: BEP x 3 remains the preferred regimen for good risk disease)
  3. **Intermediate Risk Metastatic**: 4 cycles of GUBEP (total bleomycin 360 unit)
  4. **High Risk Metastatic**: 4 cycles of GUBEP (total bleomycin 360 unit)

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dose</th>
<th>BC Cancer Administration Guideline</th>
<th>Duration</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Hydration</td>
<td></td>
<td>IV 1000 mL NS with 20 mEq potassium chloride and 2 g magnesium sulfate over 60 minutes</td>
<td>days 1 to 5*</td>
<td>every 21 days</td>
</tr>
<tr>
<td>CISplatin</td>
<td>20 mg/m²/day</td>
<td>IV in 100 mL NS over 30 minutes</td>
<td>days 1 to 5*</td>
<td>every 21 days</td>
</tr>
<tr>
<td>etoposide</td>
<td>100 mg/m²/day</td>
<td>IV in 500 mL NS over 45 minutes (use non-DEHP equipment with in-line filter)</td>
<td>days 1 to 5*</td>
<td>every 21 days</td>
</tr>
<tr>
<td>hydrocortisone</td>
<td>100 mg</td>
<td>IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bleomycin</td>
<td>30 Units</td>
<td>IV in 50 mL NS over at least 10 minutes</td>
<td>One day</td>
<td>every week to above maximum</td>
</tr>
<tr>
<td>Post-Hydration</td>
<td></td>
<td>IV 500 mL NS over 30 min to 1 hour</td>
<td>days 1 to 5*</td>
<td>every 21 days</td>
</tr>
<tr>
<td><strong>Total hydration</strong>:</td>
<td></td>
<td>IV 2150 mL NS</td>
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</table>

*NOTE: Treatment should be given on 5 consecutive days**.
**If treatment falls on a week with a statutory holiday, treatment can be scheduled over 4 days (ONLY for an exceptional situation if no option available to give over 5 days).**

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<tr>
<td>Pre-Hydration</td>
<td>IV 1000 mL NS with 20 mEq potassium chloride and 2 g magnesium sulfate over 60 minutes</td>
<td>days 1 to 4 every 21 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CISplatin</td>
<td>25 mg/m²/day</td>
<td>IV in 100 mL NS over 30 minutes</td>
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<td>every 21 days</td>
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<tr>
<td>etoposide</td>
<td>125 mg/m²/day</td>
<td>IV in 500 mL NS over 45 minutes (use non-DEHP equipment with in-line filter)</td>
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<td>every 21 days</td>
</tr>
<tr>
<td>hydrocortisone</td>
<td>100 mg</td>
<td>IV</td>
<td>bleomycin premedication</td>
<td></td>
</tr>
<tr>
<td>bleomycin</td>
<td>30 Units</td>
<td>IV in 50 mL NS over at least 10 minutes</td>
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</table>

**DOSE MODIFICATIONS:**
- No dose reduction or delay is permitted for counts.
- This program is given with curative intent and any delay or dose reduction may have serious implications and can result in inferior outcomes. In the event of elevated creatinine (e.g. greater than 200 micromol/L), neutropenic fever or low platelets, phone consultation with a contact physician is recommended.
- Prophylactic use of filgrastim is not recommended.
- Filgrastim is indicated in patients receiving their second or subsequent cycle of GUBEP who have had an episode of neutropenic fever or who have not recovered their neutrophil count by Day 5.

**PRECAUTIONS:**
1. **Bleomycin:** may cause severe and life threatening pulmonary toxicity. Limiting the total dose 270 units should decrease the risk but clinical assessment before each cycle must include a careful survey of respiratory symptoms, chest auscultation, and chest radiograph for pulmonary toxicity. Pulmonary function tests should be repeated in suspect cases. Febrile reaction can be prevented by hydrocortisone premedication. Oxygen may precipitate or aggravate bleomycin pulmonary toxicity. The Fi O₂ must not exceed 30-40% unless absolutely necessary. The anesthesiologist must be aware of the bleomycin history before any surgery: an alert bracelet is recommended.
2. **Hypersensitivity:** Monitor infusion of etoposide for the first 15 minutes for signs of hypotension. Hypersensitivity reactions have also been reported for CISplatin. Refer to BC Cancer Hypersensitivity Guidelines.
3. **Extravasation:** Etoposide causes irritation if extravasated. Refer to BC Cancer Extravasation Guidelines.
4. **Neutropenia:** Fever or other evidence of infection must be assessed promptly and treated aggressively. Avoid aminoglycoside antibiotics.
5. **Renal Toxicity**: Nephrotoxicity is common with CISplatin. Strongly encourage oral hydration. If oral hydration is not possible (e.g. excessive nausea), IV hydration is indicated. Avoid nephrotoxic drugs such as aminoglycoside antibiotics.

Call Dr. Christian Kollmannsberger or tumour group delegate at (604) 877-6000 or 1-800-663-3333 with any problems or questions regarding this treatment program.

**References**: