CARBOplatin (AUC 6) and Weekly PACLitaxel 80mg/m² followed by Dose Dense DOXOrubicin Cyclophosphamide Therapy-Triple Negative Breast Cancer Therapy

INDICATIONS FOR USE:

<table>
<thead>
<tr>
<th>INDICATION</th>
<th>ICD10</th>
<th>Regimen Code</th>
<th>Reimbursement Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoadjuvant treatment of triple negative breast carcinoma</td>
<td>C50</td>
<td>00348a</td>
<td>Hospital</td>
</tr>
</tbody>
</table>

TREATMENT:

The starting dose of the drugs detailed below may be adjusted downward by the prescribing clinician, using their independent medical judgement, to consider each patient's individual clinical circumstances.

CARBOplatin is administered on day 1 and PACLitaxel is administered on day 1, 8 and 15 of a 21 day cycle for 4 cycles or until disease progression or unacceptable toxicity develops. This is then followed by 4 cycles of DOXOrubicin and cyclophosphamide administered once every 14 days for four cycles (one cycle = 14 days)

G-CSF support (using standard or pegylated form) is required with all cycles of DOXOrubicin cyclophosphamide.

Facilities to treat anaphylaxis MUST be present when the chemotherapy is administered.

<table>
<thead>
<tr>
<th>Admin. Order</th>
<th>Day</th>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Diluent &amp; Rate</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1, 8 and 15</td>
<td>PACLitaxel</td>
<td>80mg/m²</td>
<td>IV infusion</td>
<td>250ml 0.9% NaCL over 60 min</td>
<td>1-4</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>CARBOplatin</td>
<td>AUC 6</td>
<td>IV infusion</td>
<td>500ml glucose 5% over 60 min</td>
<td>1-4</td>
</tr>
</tbody>
</table>

PACLitaxel must be supplied in non-PVC containers and administered using non-PVC giving sets and through an in-line 0.22 μm filter with a microporous membrane.

PACLitaxel should be diluted to a concentration of 0.3-1.2mg/ml.

<table>
<thead>
<tr>
<th>Admin. Order</th>
<th>Day</th>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Diluent &amp; Rate</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>DOXOrubicin</td>
<td>60mg/m²</td>
<td>IV push</td>
<td>N/A</td>
<td>5-8</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Cyclophosphamide</td>
<td>600mg/m²</td>
<td>IV infusion*</td>
<td>250ml 0.9% sodium chloride over 30 minutes</td>
<td>5-8</td>
</tr>
</tbody>
</table>

* Cyclophosphamide may also be administered as an IV bolus over 5-10mins

Lifetime cumulative dose of DOXOrubicin is 450mg/m²

In establishing the maximal cumulative dose of an anthracycline, consideration should be given to the risk factors outlined below and to the age of the patient.
NCCP Chemotherapy Regimen

CARBOplatin dose:
The dose in mg of CARBOplatin to be administered is calculated as follows:

\[
\text{(mg)} = \text{target AUC (mg/ml x min)} \times (\text{GFR ml/min +25})
\]

- Measured GFR (e.g. nuclear renogram) is preferred whenever feasible.
- Estimation of GFR (eGFR) can be done by using the Wright formula or using the Cockroft and Gault formula to measure creatinine clearance.
- The GFR used to calculate the AUC dosing should not exceed 125ml/min.
- For obese and anorexic patients the formulae may not give accurate results and measured GFR is recommended. Where obesity or overweight is likely to lead to an overestimate of GFR and isotope GFR is not available the use of the adjusted ideal body weight for Cockroft and Gault may be considered (2).

WRIGHT FORMULA
There are two versions of the formula depending on how serum creatinine values are obtained, by the kinetic Jaffe method or the enzymatic method. The formula can be further adapted if covariant creatine kinase (CK) values are available (not shown).

1. **SCr measured using enzymatic assay.**

\[
\text{GFR (ml/min)} = \frac{(6230 - 32.8 \times \text{Age}) \times \text{BSA} \times (1 - 0.23 \times \text{Sex})}{\text{SCr (μmol/min)}}
\]

2. **SCr measured using Jaffe assay**

\[
\text{GFR (ml/min)} = \frac{(6580 - 38.8 \times \text{Age}) \times \text{BSA} \times (1 - 0.168 \times \text{Sex})}{\text{SCr (μmol/min)}}
\]

Key: Sex = 1 if female, 0 if male; Age in years; BSA= DuBois BSA

COCKCROFT-GAULT FORMULA

\[
\text{GFR (ml/min)} = \frac{\text{S x (140 - age in years) x wt (kg)}}{\text{serum creatinine (micromol/L)}}
\]

S= 1.04 for females and 1.23 for males

ELIGIBILITY:
- Indications as above
- Triple negative breast cancer
- ECOG status 0-2
- Adequate organ function; ANC > 1.5 x10⁹ cells/L, platelets 75 x10⁹/L
**EXCLUSIONS:**

- Hypersensitivity to CARBOplatin*, PACLitaxel, DOXorubicin, cyclophosphamide or any of the excipients
- Congestive heart failure (LVEF < 50%) or other significant heart disease
- Disease progression while receiving platinum based chemotherapy
- Pregnancy or lactation
- Severe hepatic impairment (PACLitaxel)
- Baseline neutrophil count < 1.5 x 10^9 cells/L

*If it is felt that the patient may have a major clinical benefit from CARBOplatin, it may in exceptional circumstances be feasible to rechallenge a patient with a prior mild hypersensitivity reaction e.g using a desensitisation protocol, but only with immunology advice, premedication as advised, and a desensitisation protocol under carefully controlled conditions with resuscitation facilities available and medical and/or ITU/ HDU supervision (4).

**PRESCRIPTIVE AUTHORITY:**
The treatment plan must be initiated by a Consultant Medical Oncologist

**TESTS:**

**Baseline tests:**
- FBC, liver and kidney profile
- Audiometry and creatinine clearance as clinically indicated.
- ECG
- MUGA or ECHO (LVEF > 50% to administer doxorubicin) if >65 years or if clinically indicated (e.g. smoking history, hypertension).

**Regular tests:**
- FBC weekly during treatment
- Liver and kidney profiles weekly
- Assessment of peripheral neuropathy status before each cycle (PACLitaxel only)
- If clinically indicated creatinine, MUGA scan or echocardiogram

**Disease monitoring:**
Disease monitoring should be in line with the patient’s treatment plan and any other test/s as directed by the supervising Consultant.

**DOSE MODIFICATIONS:**
- Any dose modification should be discussed with a Consultant.

<table>
<thead>
<tr>
<th>Table 1: Dose Reduction Levels for PACLitaxel and CARBOplatin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>PACLitaxel</td>
</tr>
<tr>
<td>CARBOplatin</td>
</tr>
</tbody>
</table>
### Haematological:

#### Table 2: Dose modification of CARBOplatin and PACLitaxel in haematological toxicity (CYCLE 2-4)

<table>
<thead>
<tr>
<th>Day</th>
<th>ANC (x10⁹/L)</th>
<th>Platelets (x10⁹/L)</th>
<th>CARBOplatin Dose</th>
<th>PACLitaxel Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>≥1 and ≥75</td>
<td></td>
<td>100% Dose</td>
<td>100% Dose</td>
</tr>
<tr>
<td></td>
<td>&lt;1 and/or &lt;75</td>
<td></td>
<td>Delay treatment until recovery *</td>
<td>Delay treatment until recovery *</td>
</tr>
<tr>
<td>Day 8, 15</td>
<td>&lt;0.5 and/or &lt;50</td>
<td></td>
<td>Omit day 8 and day 15 PACLitaxel dose</td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>Febrile Neutropenia</td>
<td></td>
<td>Decrease CARBOplatin dose by one dose level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;0.5 for ≥7 days or &lt;10</td>
<td>10 to 50 with bleeding tendencies</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Treatment delay for haematological toxicity &gt; 1 week 1st occurrence</td>
<td>Decrease CARBOplatin dose by one dose level to AUC 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd occurrence</td>
<td>Decrease CARBOplatin dose further for subsequent cycles to AUC 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Treatment may be delayed for a maximum of 3 weeks.

#### Table 3: Dose modification of DOXOrubicin and cyclophosphamide in haematological toxicity (CYCLE 5-8)

<table>
<thead>
<tr>
<th>ANC (x10⁹/L)</th>
<th>Platelets (x10⁹/L)</th>
<th>Dose (All Drugs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1.0 and ≥100</td>
<td>Delay for 1 week (or longer if needed), then give 100% dose if ANC &gt; 1.0 and platelets ≥ 100.</td>
<td></td>
</tr>
<tr>
<td>&lt; 1.0 and ≥100</td>
<td>Delay for 1 week (or longer if needed), then give 100% dose if ANC &gt; 1.0 and platelets ≥ 100.</td>
<td></td>
</tr>
<tr>
<td>≥ 1.0 And &lt;100</td>
<td>Delay for 1 week (or longer if needed), then give 100% dose if ANC &gt; 1.0 and platelets ≥ 100. Dose reduce to 75% after a second delay.</td>
<td></td>
</tr>
</tbody>
</table>
Renal and Hepatic Impairment:

Table 4: Dose modification in renal and hepatic impairment

<table>
<thead>
<tr>
<th>Drug</th>
<th>Renal Impairment</th>
<th>Hepatic Impairment</th>
<th>ALT</th>
<th>Total Bilirubin</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBOplatin</td>
<td>See note below*</td>
<td>No dose modification required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PACLitaxel</td>
<td>No recommended dose modifications in renal impairment</td>
<td>ALT &lt; 10xULN and ≤ 1.25xULN, 80mg/m²²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALT &lt; 10xULN and 1.26-2xULN, 60mg/m²²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALT &lt; 10xULN and 2.01-5xULN, 40mg/m²²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALT ≥10xULN and &gt;5xULN, Not recommended</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclophosphamide</td>
<td>Creatinine Clearance (mL/min)</td>
<td>Dose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 10</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; 10</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DOXOrubicin</td>
<td>No dose modification recommended. Clinical decision in severe impairment</td>
<td>Serum Bilirubin (micromol/L)</td>
<td>Dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20-50</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 51-85</td>
<td>25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;85</td>
<td>Omit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If AST 2-3 x normal, give 75% dose.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If AST &gt;3x ULN, give 50% dose</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Renal dysfunction and CARBOplatin

- Patients with creatinine clearance values of < 60mL/min are at greater risk to develop myelosuppression.
- In case of GFR ≤ 20mL/min carboplatin should not be administered at all.
- Modification of dose based on renal function
  - If Cockroft & Gault or Wright formula are used, the dose should be adjusted per cycle based on a serum creatinine obtained within 48 hrs of drug administration.
  - If isotope GFR is used, the dose should remain the same provided the serum creatinine is ≤110% of its value at the time of the isotope measurement. If the serum creatinine is higher than this, consideration should be given to re-measuring the GFR or to recalculating using Cockroft & Gault or Wright formulae taking care this does result in a dose reduction.

The information contained in this document is a statement of consensus of NCCP and ISMO or IHS professionals regarding their views of currently accepted approaches to treatment. Any clinician seeking to apply or consult these documents is expected to use independent medical judgement in the context of individual clinical circumstances to determine any patient's care or treatment. Use of these documents is the responsibility of the prescribing clinician and is subject to HSE’s terms of use available at [http://www.hse.ie/eng/Disclaimer](http://www.hse.ie/eng/Disclaimer). This information is valid only on the day of printing, for any updates please check [www.hse.ie/NCCPchemoregimens](http://www.hse.ie/NCCPchemoregimens).
Management of adverse events:

Table 5: Dose Modification of PACLitaxel for Adverse Events

<table>
<thead>
<tr>
<th>Adverse reactions</th>
<th>Recommended dose modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade ( \geq 2 ) motor or sensory neuropathy First Occurrence</td>
<td>Decrease dose of PACLitaxel by 10mg/m².</td>
</tr>
<tr>
<td>Persistent Grade ( \geq 2 ) or ( 2^{nd} ) occurrence</td>
<td>Decrease dose of PACLitaxel by a further 10mg/m².</td>
</tr>
<tr>
<td>All other grade 2 non-haematological toxicity</td>
<td>Hold treatment until toxicity resolves to ( \leq ) grade 1. Decrease subsequent doses by 10mg/m².</td>
</tr>
<tr>
<td>( \geq ) Grade 3 reaction</td>
<td>Discontinue</td>
</tr>
</tbody>
</table>

Patients who cannot tolerate treatment after 2 dose reductions or require a treatment delay of greater than 2 weeks, should discontinue treatment.

**SUPPORTIVE CARE:**

**EMETOGENIC POTENTIAL:**

CARBoplatin and PACLitaxel cycles: High, Day 1 *(Refer to local policy)*

Low, Day 8 and 15 *(Refer to local policy)*

DOXOrubicin cyclophosphamide cycles: High *(Refer to local policy).*

**PREMEDICATIONS:**

All patients must be premedicated with corticosteroids, antihistamines, and H₂ antagonists prior to PACLitaxel treatment. DOXOrubicin cyclophosphamide cycles: None usually required

Table 6: Suggested premedications prior to treatment with PACLitaxel

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Administration prior to PACLitaxel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dexamethasone</td>
<td>10mg IV</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Chlorphenamine</td>
<td>10mg IV</td>
<td>30 minutes</td>
</tr>
<tr>
<td>RaNiTidine c</td>
<td>50mg IV</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

a Dose of dexamethasone may be reduced or omitted in the absence of hypersensitivity reaction according to consultant guidance.

b Dose of dexamethasone may be altered in the event of hypersensitivity reaction to 20 mg of dexamethasone orally 12 and 6 hr prior to re-challenge with PACLitaxel according to consultant guidance.

c or equivalent e.g. Cimetidine

**OTHER SUPPORTIVE CARE:**

Myalgias and arthralgias may occur with PACLitaxel. Analgesic cover should be considered.
ADVERSE EFFECTS / REGIMEN SPECIFIC COMPLICATIONS
The adverse effects listed are not exhaustive. Please refer to the relevant Summary of Product Characteristics for full details.

- Neutropenia: Fever or other evidence of infection must be assessed promptly and treated appropriately.
- Hypersensitivity: Reactions to CARBOplatin may develop in patients who have been previously exposed to platinum therapy. However allergic reactions have been observed upon initial exposure to CARBOplatin. Severe hypersensitivity reactions characterised by dyspnoea and hypotension requiring treatment, angioedema and generalised urticaria have occurred in <1% of patients receiving PACLitaxel after adequate premedication. In the case of severe hypersensitivity reactions, PACLitaxel infusion should be discontinued immediately, symptomatic therapy should be initiated and the patient should not be re-challenged with the drug.
- Neurotoxicity and otoxicity: Neurological evaluation and an assessment of hearing should be performed on a regular basis, especially in patients receiving high dose CARBOplatin. Neurotoxicity, such as paraesthesia, decreased deep tendon reflexes, and otoxicity are more likely seen in patients previously treated with cisplatin, other platinum treatments and other ototoxic agents. Frequency of neurologic toxicity is also increased in patients older than 65 years.
- Peripheral neuropathy: Occurs frequently but the development of severe symptoms is rare. In severe cases, a dose reduction may be considered for all subsequent courses of PACLitaxel as per consultant guidance.
- Arthralgia/myalgia: May be severe in some patients; however, there is no consistent correlation between cumulative dose and infusion duration of PACLitaxel and frequency or severity of the arthralgia/myalgia. Symptoms are usually transient, occurring within 2 or 3 days after PACLitaxel administration, and resolving within days. Dose reducing PACLitaxel may lessen the severity of arthralgias/myalgias; however, there is no data on efficacy of reduced doses in a curative setting. Dose reduction should be considered only if symptom severity precludes continuing PACLitaxel.
- Extravasation: PACLitaxel causes pain and tissue necrosis if extravasated. DOXOrubicin may cause pain and tissue necrosis if extravasated. (Refer to local policy).
- Hepatic Dysfunction: Patients with hepatic impairment may be at increased risk of toxicity, particularly grade 3-4 myelosuppression.
- Cardiac conduction abnormalities: If patients develop significant conduction abnormalities during PACLitaxel administration, appropriate therapy should be administered and continuous cardiac monitoring should be performed during subsequent therapy with PACLitaxel. Hypotension, hypertension, and bradycardia have been observed during PACLitaxel administration; patients are usually asymptomatic and generally do not require treatment. Frequent vital sign monitoring, particularly during the first hour of PACLitaxel infusion, is recommended.
- Cardiac Toxicity: DOXOrubicin is cardiotoxic and must be used with caution, if at all, in patients with severe hypertension or cardiac dysfunction.
- SIADH (syndrome of inappropriate secretion of antidiuretic hormone): may occur in patients receiving cyclophosphamide, resulting in hyponatremia, dizziness, confusion or agitation, unusual tiredness or weakness. This syndrome is more common with doses >50 mg/kg and may be aggravated by administration of large volumes of fluids to prevent hemorrhagic cystitis. The condition is self-limiting although diuretic therapy may be helpful in the situation when the patient has stopped urinating (especially if this occurs during the first 24 hours of cyclophosphamide therapy). Susceptible patients should be monitored for cardiac decompensation.
**NCCP Chemotherapy Regimen**

**DRUG INTERACTIONS:**
- Avoid concurrent use with nephrotoxic drugs (e.g. aminoglycosides, furosemide, NSAIDS) due to additive nephrotoxicity. If necessary monitor renal function closely.
- Avoid concurrent use with ototoxic drugs (e.g. aminoglycosides, furosemide, NSAIDS). When necessary perform regular audiometric testing
- Risk of drug interactions causing increased concentrations of PACLitaxel with CYP3A inhibitors.
- Risk of drug interactions causing decreased concentrations of PACLitaxel with CYP3A inducers.
- CYP3A inhibitors decrease the conversion of cyclophosphamide to both its active and inactive metabolites. Patients should also be counselled with regard to consumption of grapefruit juice.
- CYP3A inducers may also increase the conversion of cyclophosphamide to both its active and inactive metabolites.
- Concurrent administration of calcium channel blockers with doxorubicin should be avoided as they may decrease the clearance of doxorubicin.
- Current drug interaction databases should be consulted for more information.

**ATC CODE:**
- CARBOplatin L01XA02
- PACLitaxel L01CD01
- Doxorubicin L01DB01
- Cyclophosphamide L01AA01

**REFERENCES:**
4. NCCN Guidelines Version1.2015 Epithelial Ovarian Cancer/Fallopian Tube Cancer/Primary Peritoneal Cancer
NCCP Regimen: Carboplatin (AUC 6) and weekly PACLitaxel 80mg/m²-Triple Negative Breast Cancer

Published: 01/12/2016
Review: 26/11/2020
Version number: 4

Tumour Group: Breast
NCCP Regimen Code: 00348
ISMO Contributor: Prof Maccon Keane
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Cardiotoxicity is a risk associated with anthracycline therapy that may be manifested by early (acute) or late (delayed) effects.

Risk factors for developing anthracycline-induced cardiotoxicity include:

- high cumulative dose, previous therapy with other anthracyclines or anthracenediones
- prior or concomitant radiotherapy to the mediastinal/pericardial area
- pre-existing heart disease
- concomitant use of other potentially cardiotoxic drugs

In establishing the maximal cumulative dose of an anthracycline, consideration should be given to the risk factors above and to the age of the patient.