Prof. Dr. A.B. (Arie) van Vugt on nondisplaced femoral neck fractures.

Could you introduce yourself?

My name is Arie van Vugt. I've more than thirty years experience in trauma surgery. I published my thesis in 1991; the subject was the treatment of intracapsular hip fractures with Dynamic Hip Screws. Later on, I became chair of the guideline committee for the treatment of hip fractures in elderly people in the Netherlands, a cooperation of the Dutch Surgical Society and the Dutch Orthopaedic Society.

Apart from your past, do you still have connections with the hip fracture?

Of course, the hip fracture, which is the epidemic disease of this century, has always been in my mind and is still in my heart after thirty years, it's an important subject.

What makes the hip fracture special?

Femoral neck fracture is a known problem of course, not only because of the biologics, not only because of the avascular necrosis of the hip but also the biomechanical problems.

What could you tell us about osteosynthesis of the intracapsular fracture?

It is obvious that the most delicate operation that you can do from the minimal invasive aspect is using cannulated screws. It is also obvious, from the biomechanical point of view, that the cannulated screws are far inferior to a screw/nail plate fixation.
With a screw plate fixation, such as the compression hip screw already introduced in 1957 by John Charnly, you fix the screw in the head of the femur, with a plate construction to the femoral shaft. This is much more reliable from the stability point of view.

For the undisplaced fracture, where the fracture system seems to possess a more or less intrinsic stability, cannulated screws are widely used but from a biomechanical point of view, it is inferior.

It is obvious that for a compression hip screw you do need a larger incision than for the small stab incisions in case of cannulated screws but also it is a limited invasive technique.

What is your opinion on the Gannet?

It is obvious that with a screw fixation in the femoral head, the rotational stability is not secured adequately and that is probably the most important reason for secondary dislocation and failure of the fixation. That's why one of my colleagues developed the Gannet. The idea of the Gannet is that you push a blade in the head of the femur and perpendicular to the direction of the blade, the anchors are turned out and the combination of the blade, plate and the two anchors results in a far better rotational stability than the original compression hip screw.

Do you have scientific evidence?

Of course, the stability has been tested in the laboratory environment, including cadaver bone studies and the rotational stability is double as compared to sliding hip screws. These studies have been published in peer-reviewed journals. Upon these laboratory studies we started with a prospective cohort study in several hospitals in the Netherlands. Till now, 400 patients have been included. A new publication has already been reviewed and accepted (200 patients, undisplaced fracture) with promising results.

You seem to be enthusiastic about the Gannet, but no randomised controlled trials have been executed.

It is a fact that the best proof, from a scientific point of view, consists of a Randomised Controlled Trial, which is not available for the Gannet.

We did a prospective cohort study and compared this in a longitudinal study with our results with the compression screws and cannulated screws. The results from this comparison are a reduction rate of re-operations of 50%.

Are many hospitals underestimating their re-interventions?

It is obvious that if you don't look for your complications you won't see your complications.

Is the Gannet causing a shockwave?

I think people will be enthusiastic about the results and the concept of thinking about the rotational stability because it is easy to recognise the problem; but does it give a shockwave, the answer is NO.

Your take away message?

I think that the surgeon who is critical to his own results will be eager to give it a try.
In general, the re-intervention rate in undisplaced femoral neck fractures amounts to 10 – 12%. In case of 125 patients this yields 14 re-interventions. A re-intervention means removal of the osteosynthetic material and the insertion of a hip replacing device.

The clinical results of the first 800 patients treated with the Gannet are becoming available. Six hospitals in the Netherlands are participating in the study. Independent studies are being organised in Denmark and in Belgium. The outcome of the first cohort of patients with undisplaced fractures and treated with the Gannet has been accepted for publication; out of 149 patients the result was 6 failures (4%). Published in the European Journal of Trauma and Emergency Surgery by van Walsum et al. 2016. Calculation on basis of 125 patients yields five re-interventions.

By applying the Gannet, a reduction in re-operation rate has been obtained from 14 re-operations in case of sliding hip screw or cannulated screws to 5 re-operations in case of Gannet. This means that at least nine patients are circumventing a re-operation and subsequently hip replacement. These patients are evading additional suffering.

Not just the patients are benefitting, it is also cost effective for the hospital: although the Gannet is 400 Euro more expensive than the SHS (additional costs being 125 times 400 Euro = 50,000 Euro), unequivocally at least nine surgeries are waived, hence generating costs savings of 9 surgeries at 6,000 Euro (saving 9 times 6,000 Euro = 54,000 Euro). In a time of budget restraint, better results associated with fewer surgeries are very welcome.

By applying the Gannet with nondisplaced fractures, in 125 cases a reduction in re-operation rate has been obtained from 14 re-operations in case of sliding hip screw or cannulated screws to 5 re-operations in case of Gannet. This means that at least nine patients are circumventing a re-operation and subsequently hip replacement.

### Femoral Neck fractures distribution

<table>
<thead>
<tr>
<th>Treatment of nondisplaced fractures (all pts)</th>
<th>Patients</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displaced fractures, biological ‘young’ pts</td>
<td>125</td>
<td>IF</td>
</tr>
<tr>
<td>Displaced fractures, biological ‘old’ pts</td>
<td>105</td>
<td>IF</td>
</tr>
<tr>
<td>Total number</td>
<td>270</td>
<td>HR</td>
</tr>
</tbody>
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**Figure 1.** Normal distribution of nondisplaced & displaced fractures in 500 pts.
Directly in the beginning, the approach of developing a new device, specifically designed for femoral neck fractures, has been based on science. The biomechanical considerations and results were published in peer reviewed magazines (Injury, Int. J. Care Injured 40 (2009) 283-287).

Also, the first case series (25 patients) were published in peer reviewed magazines (Arch. Orthop. Trauma Surg. (2011) 131:519-524).

Currently, we are in the stage of finalizing the results of the treatment with the Gannet, with a follow up of at least one year, with close to 800 patients. The results of the first batch (149 patients with undisplaced femoral neck fractures) has been accepted for publication in the European Journal of Trauma and Emergency Surgery.
Denmark has a strong and long tradition in Orthopaedics. Denmark not only has achieved international recognition for the large number of randomised studies on spine surgery as well as cohort studies from the Danish Hip Registry, the country was at the basis of many international scientific organisations. The Danish Orthopedic Society is a founding member of the Nordic Orthopaedic Federation (NOF), which is comprised of Iceland, Norway, Sweden, Finland, Holland, Estonia and Denmark. The NOF is very active and the following scientific meeting of the NOF will be in Reykjavik, Iceland in June 2018. The NOF owns Acta Orthopaedica (previously Acta Orthopaedica Scandinavica). Acta Orthopaedica is a non-profit journal. Since 2005 Acta is a so called platinum Open Access journal, which means that it is not only free to the general reader but articles are published with no costs to authors. The articles are immediately, after authors have approved proofs, presented in PubMed (abstract) with a link to PubMedCentral (full article). Furthermore, the entire Acta production, since the very start in 1930 is free. Furthermore, amongst other things, Denmark is a founding member of EFORT, the following scientific conference will take place in Vienna, Austria, June 2017. Therefore, we at Gannet, are proud that Denmark is the second country in which the Gannet has been actually introduced. The Danish surgeons will do their own independent scientific research on the results obtained with the Gannet.
Gardener or cabinetmaker?

BIOLOGY IS THE MOTHER OF ALL FIXATION

Bone is a plant with its roots in the soft tissue and it requires for its welfare the skills of a gardener rather than those of a cabinetmaker

G.R. Girdlestone

When we observe a problem with fixation of a certain fracture, it may be wise to go back to the biology of that fracture. We analysed the femoral neck fracture, as the implant to be designed should follow the biology of the fracture. And indeed, the biology of the femoral neck fracture is really interesting.

Two Achilles heels characterize the healing of a femoral neck fracture, from a biological perspective:

- The type of bone healing (no callus formation, therefore vulnerable healing process).
- The viability of the femoral head after fracture (revascularization issue).

These findings serve as the basis for the characteristics of the Gannet.

The Sliding Hip Screw is the benchmark nowadays. The advantages of the SHS include good angular stability, the major disadvantage of the SHS implants being limited rotational stability. Fixation of the sliding hip screw is not improved when supplemented by a proximal cancellous screw. Another negative point is the relative large volume of the implant in the femoral head, which increases the risk of avascular necrosis.

These above mentioned implant related factors are the basis for the development of a new implant, specifically designed for the operative fixation of femoral neck fractures. The design combines the positive characteristics of the current benchmark (SHS) with the outcome of the biological perspective. The design is named ‘Gannet’, after the seabird. This dynamic locking blade plate (DLBP) combines the biology in alignment with Girdlestone and combined with the positive aspects of the SHS.
Abstract

Background

This study evaluated the clinical results of a new implant in the internal fixation of undisplaced femoral neck fractures.

Method

Irrespective of their age, 149 patients with undisplaced (Garden I and II) femoral neck fractures were included in a prospective multicentre clinical cohort study and were treated by internal fixation by means of the Dynamic Locking Blade Plate (DLBP). The mean age was 69 years and the follow-up at least one year.

Results

The DLBP fixation resulted in 6 out of 149 failures caused by AVN (2x), non-union (2x), loss of fixation (3x) or combination of these.

Conclusion

The fixation of undisplaced femoral neck fractures by the DLBP resulted in a low failure rate of 4%.